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**PILOT TEST WORK PLAN
METAL SHREDDER RESIDUE TREATABILITY STUDY**

Prepared for

Institute of Scrap Recycling Industries, California Chapter

Prepared by

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ACRONYMS AND ABBREVIATIONS

COC	chain of custody
DTSC	Department of Toxic Substances Control
EPA	Environmental Protection Agency
L	liter
µg/L	micrograms per liter
mg/L	milligrams per liter
mL	milliliter
MS	mass spectrometry
MSDS	material safety data sheet
MSR	Metal Shredder Residue
RCRA	Resource Conservation and Recovery Act
STLC	Soluble Threshold Limit Concentration
TMSR	Treated Metal Shredder Residue
TTLC	Total Threshold Limit Concentration
Terraphase	Terraphase Engineering Inc.
WET	Waste Extraction Test

1.0 INTRODUCTION

Terraphase Engineering Inc. (Terraphase) has prepared this *Metal Shredder Residue Pilot Test Work Plan* (Work Plan) on behalf of the California Chapter of the Institute of Scrap Recycling Industries (ISRI). The proposed pilot test is part of a larger treatability study, originally proposed in the *Metal Shredder Residue Treatability Study Work Plan* (Terraphase 2014), which presented a detailed approach for a bench-scale study and a general approach for pilot-scale field testing. The overarching purpose of the bench-scale and pilot-scale studies is to confirm and optimize the effectiveness of previously established methods that are currently used to treat metal shredder residue (MSR) prior to disposal or use of the treated material as alternative daily landfill cover (ADC).

The results of the bench-scale study provided the basis for the design of a pilot-scale study. This Work Plan presents a detailed approach for the implementation of a pilot-scale field test to confirm the effectiveness of treatment reagent combinations selected during the bench-scale treatability study.

1.1 Background

1.1.1 Description of Metal Shredder Residue

MSR is a heterogeneous mixture of largely non-metallic materials resulting from the shredding of auto bodies, appliances, and other scrap metal materials. A metal shredder is a large, electric-powered hammermill that pulverizes metal into fist-sized pieces which are then sorted by different “downstream” metal separation processes including magnets, trommels, screens, optical scanners, eddy currents, and other types of proprietary process equipment. MSR is the material that remains after ferrous and nonferrous metals have been separated and removed from the shredder output material. Shredder output material is comprised of a shredded ferrous iron product and a mostly non-magnetic material known in the industry as “aggregate”.

Aggregate is an intermediate process material that contains significant amounts of valuable ferrous and nonferrous metal that are separated by downstream processing equipment and sold as commodities. In contrast, MSR consists primarily of foam, fabric, plastics, rubber, tires, glass, wood, and other debris, along with minute amounts of remaining metallic material that is too small to be economically separated and removed from the aggregate. Near the end of processing for metals separation and removal, MSR is sent to an in-line treatment system where it is treated prior to transport off-site, primarily for use as ADC. Treated MSR (TMSR) is subject to a final magnetic screen for removal of residual ferrous material before being stockpiled for eventual transport to the landfill.

MSR is classified and managed as a nonhazardous waste under the federal hazardous waste management program (RCRA) in most jurisdictions. However, California’s hazardous waste classification scheme is more stringent than the federal scheme, and considers wastes, unless exempted or excluded from regulation, to be hazardous if they exceed regulatory thresholds

known as Total Threshold Limit Concentrations (TTLCs) or Soluble Threshold Limit Concentrations (STLCs). These limits are established for 17 metals, several of which are commonly found in MSR. For the purpose of comparison with the STLCs, the extractable concentration of a metal is determined through application of the Waste Extraction Test (WET). The WET procedure uses a citrate extraction solution, which is more aggressive than the acetate solution that is used in the federal Toxicity Characteristic Leaching Procedure (TCLP). The California classification scheme also regulates metals that are not regulated under RCRA, including copper, nickel and zinc. Testing of MSR has shown that it typically contains certain metals in excess of TTLCs, and certain extractable metals in excess of the STLCs, as determined by the WET. Other state toxicity characteristics (e.g., aquatic toxicity) are not exhibited by treated or untreated MSR.

1.2 Treatability Study Goals

The treatability study was designed to demonstrate the effectiveness of the existing MSR treatment technology and to identify an optimal treatment reagent mix that is protective of human health and the environment but does not result in unnecessary overtreatment or excessive material bulking.

The specific goals of the treatability study include:

- Establish the baseline characteristics of untreated MSR;
- Evaluate several treatment reagent mixes in bench-scale testing;
- Demonstrate that the treatment process will have long-term effectiveness in a landfill environment;
- Select an optimal treatment formula or formulas to be used in pilot-scale testing; and
- Conduct pilot-scale tests using a selected treatment formula to confirm effectiveness at field scale.

The purpose of the pilot test proposed herein is to confirm the field-scale effectiveness of the treatment reagent combinations which were selected at the conclusion of the bench-scale treatability study.

2.0 PILOT TEST APPROACH

2.1 General Approach

The MSR treatment process that will be implemented during the pilot test includes the in-line application of a silicate solution and an alkaline activator. The initial step in the treatment process is the thorough wetting of the residue by the liquid silicate blend as it enters the pug mill mixer. After the wetted material is thoroughly mixed, the alkaline activator is added and the mixing continues in the remainder of the pug mill screw. Treated MSR is passed under a final metal screen for further metal recovery and then discharged and conveyed onto a stockpile.

The treatment reagent combinations selected for evaluation will be applied at each of five participating shredder facilities:

- SA Recycling facilities in Anaheim, Bakersfield, and Los Angeles, California (“the SA facilities”)
- Schnitzer Steel Products in Oakland, California (“the Schnitzer facility”)
- Sims Metal Management in Redwood City, California (“the Sims facility”).

The locations of the shredder facilities are presented on Figure 1.

2.2 Treatment Reagents

Each facility uses a combination of silicate solution and alkaline activator (cement) for MSR treatment. The material safety data sheets (MSDSs) for the reagents described below are included in Appendix A.

The treatment reagent combinations selected for evaluation during the pilot test include:

- Silicate dosage of 0.5 gal per ton of MSR and cement dosage of 5% by wet weight, and
- Silicate dosage of 1.0 gal per ton of MSR and cement dosage of 10% by weight.

Each treatment dosage combination will be applied during a complete 8-hour shift at each facility during the pilot test.

The sample collection portion of the pilot test will be performed over a period of two 8-hour shifts at each of the five facilities, for a total duration of 10 days. Each of the two treatment reagent combinations will be applied for one 8-hour shift at each facility.

2.2.1 SA Recycling

The MSR treatment reagents used by the SA facilities are:

- Silicate solution: HP Treatment, which contains approximately 5 to 10% sodium and potassium silicate, and is manufactured by C.C.I. Chemical Corporation.
- Alkaline Activator: PV Cement manufactured by Diversified Minerals, Inc.

2.2.2 Sims and Schnitzer

The MSR treatment reagents used by both the Sims facility and the Schnitzer facility are:

- Silicate solution: Metbond MCX-90, which contains approximately 70% sodium silicate, and is manufactured by Envirokem Engineering Service.
- Alkaline Activator: Portland cement, manufactured by Lehigh Southwest Cement Company.

2.3 Application of Treatment Reagents

The volume of silicate solution applied to MSR during the treatment process will be measured in gallons of silicate per ton of MSR undergoing treatment. The alkaline activator dosage rate will be measured as a percentage of the weight of the MSR undergoing treatment. The treatment reagent dosage rates will be confirmed using a mass balance approach and MSR throughput measurements.

2.3.1 SA Recycling

At each of the three participating SA facilities, the weight of the untreated MSR conveyed into the treatment chamber is measured using a belt scale. HP Treatment is drawn into a foamer and mixed with air and water, provided by separate lines, before being pumped to the treatment chamber which houses an auger. HP Treatment is applied to the MSR conveyed into the treatment chamber via two nozzles, prior to application of the alkaline activator. Dosage is monitored visually and confirmed by measuring and recording the volume of HP Treatment used per shift, in units such as gallons or liters. The moisture content of untreated and treated MSR at the SA facilities ranges from 25% to 45%. The moisture applied to MSR during treatment is equal to approximately 5% by weight, and is applied at a rate of approximately 3 to 5 gallons per minute.

The PV Cement is stored in silos adjacent to the treatment chamber. Internal augers deliver cement to chutes that feed it into the treatment chamber. Dosage is set as a percentage of the weight of untreated MSR, and handled by the Material Recovery Plant computer automation system. The incoming untreated MSR weight is monitored by a belt scale, and the silo's internal auger and scale are integrated to maintain dosage.

2.3.2 Sims

At the Sims facility, the untreated MSR is separated into two streams; one stream comprises particles under 1.25 inches and represents approximately 70% of the total MSR throughput; the remaining 30% comprises particles between 1.25 and 4.5 inches. The treatment reagents are applied to each stream at equal concentrations. The moisture content of untreated and treated MSR at the Sims facility is generally below 30%.

The silicate solution, Metbond, is mixed with water in a two-compartment tank. The Metbond from one compartment is metered along with water into a second compartment and is then pumped to a series of spray nozzles for each stream, which wet the MSR as it is conveyed to the discharge belt. The automation software allows for controlled mixture and delivery of the diluted silicate solution to each of the MSR streams. The moisture applied to MSR during treatment is equal to approximately 8% by weight, and is applied at a rate of approximately 3 gallons per minute for the 1.25-inch-plus stream, and 10 gallons per minute for the 1.25-inch-minus stream.

After the two MSR streams have been sprayed with the diluted silicate solution in separate treatment process lines, each stream is conveyed to its respective mixing screw conveyor. Dry cement is introduced into each mixing conveyor from two large storage silos via two independent rotary valves connected to a variable-speed metering screw. The cement delivery rate for each process line is set by automation software which controls the speed of the feed screw proportionate to the weight of MSR conveyed over each belt scale.

2.3.3 Schnitzer

The weight of untreated MSR conveyed to the treatment system at Schnitzer is measured in tons per hour using automation software. The dosage of silicate solution, Metbond, is measured in gallons of silicate per ton of incoming MSR and is periodically calibrated using the following procedure. The desired number of gallons per ton is multiplied by the measured MSR throughput and then divided by 60 to determine the required gallons of silicate per minute. Over a period of one minute, the cement dispensed into the treatment system is collected and measured for comparison with the desired volume of silicate per minute, and the silicate metering pump is adjusted as needed. The moisture applied to MSR during treatment is equal to approximately 10% by weight, and is applied at a rate of approximately 12 gallons per minute. The moisture content of untreated MSR at the Schnitzer facility is generally within the range of 18% to 29%, with moisture content values up to 37% during rain events. The moisture content of treated MSR at the Schnitzer is generally within the range of 25% to 35%, with moisture content up to 43% during rain events.

The cement dosage is a percentage of the weight of incoming MSR and is periodically calibrated using the following method. The desired cement percentage is multiplied by the measured MSR throughput then divided by 60 to determine the required weight of cement per minute. Over a period of one minute, the cement dispensed into the treatment system is collected and weighed for comparison with the desired weight of cement per minute, and the cement metering device is adjusted as needed.

3.0 SAMPLING AND ANALYSIS

The pilot test will include the collection of untreated and treated MSR samples from each of the five participating shredder facilities. The samples will be submitted for milling and chemical analysis. Sample collection, handling, and analytical procedures are presented below.

3.1 Sample Collection and Processing

A clean shovel will be placed in the discharge stream to collect MSR. The shovel will be decontaminated in accordance with procedures outlined in the Quality Assurance Project Plan (Terraphase 2014b; “the QAPP”). The sampling point for untreated residue is the location prior to the point where the MSR enters the treatment system. Treated samples will be collected immediately after the point where the treated MSR passes a final magnet, and before it falls onto a stockpile.

Samples of untreated and treated MSR from the pilot-scale test will be submitted to the analytical laboratory for analysis using the Waste Extraction Test (WET). Samples will be handled and submitted for analysis according to the procedures described below.

Untreated and treated discrete samples will be collected at a frequency of once per hour during two eight-hour shifts, resulting in a total of 32 samples per facility. To collect each discrete sample, a 5-gal bucket will be filled with either untreated or treated MSR. It is anticipated that the contents of the bucket will have a mass of approximately 5 to 15 kg. Samples will not be homogenized in the field because each sample will be milled, as discussed in Section 3.2. The contents of each bucket will be placed on plastic sheeting and coning and quartering will be performed to produce two replicate samples with a mass of at least 400 grams each, as discussed below. The mass will be confirmed in the field using a portable scale. Each sample will be photo-documented in its entirety in the field. One replicate sample will be submitted for milling and analysis and the other replicate sample will be provided to the Department of Toxic Substances Control (DTSC), if requested.

A mass of 400 grams will be sufficient to perform the analyses described in Section 3.3. However, samples of greater mass may need to be collected if a given sample includes an unusually large fraction of large MSR fragments that may bias the overall sample composition. A representative fraction of larger particles may be cut in the field to facilitate inclusion in samples. MSR fragments cut in the field will be photo-documented.

Incidental objects made of elemental metal (e.g., nuts, bolts, coins, nails, etc.) will be manually removed from the MSR samples after coning and quartering has been performed. Metal objects that are removed will be photo-documented.

3.2 Field Documentation and Sample Handling

Samples will be submitted in food-grade plastic containers. Sample containers will be labeled with the following information:

- Project name
- Sample identification
- Date and time of sample collection
- Sampler's initials
- Requested analyses

Sample labels will be completed in waterproof, permanent ink, and will have a self-adhesive backing to allow for attachment to the sample container. Samples will be placed in an ice-chilled cooler for transport. When shipping is required, bubble wrap or similar packing material will be used to prevent breakage during transport. Wet ice or "blue ice" will be packaged in double plastic sealable bags to prevent leakage. The sealed bags will be placed around, among, and on top of the samples. The cooler will be sealed with packing tape and the shipping label will be affixed to the top of the cooler.

For each sample that is submitted to a laboratory for analysis, an entry will be made on a chain-of-custody (COC) form. COCs will be prepared for groups of samples collected at a given location on a given day. Original COCs will accompany each shipment of samples to the laboratory. Scanned versions of COCs will be kept in the project file. The COC documents the identity of all personnel involved in sample transfer. The following information is entered on the COC:

- project name and number
- COC serial number
- project location
- sample numbers
- sampler's/recorder's signature
- date and time of collection
- number and type of containers
- sample matrix
- analyses requested for each sample
- preservation method
- name of person receiving the samples
- date and time of receipt of samples
- address of laboratory
- additional remarks (e.g., special handling or analysis requirements)

Sampling team members will maintain custody of the samples until they are relinquished to laboratory personnel or a professional courier service. The COC form will accompany the samples from the time of collection until they are received by the laboratory. Each party in

possession of the samples (except the professional courier service) will sign the COC form signifying receipt. The COC form will be placed in a plastic bag and shipped in the cooler with the samples. A copy of the original completed COC will be provided by the laboratory along with the report of results. Upon receipt, the laboratory will inspect the condition of the sample containers and report the information on the COC or a sample receipt form. The method of sample shipment will be noted on the COC. Strict COC procedures will be maintained during sample handling. Sample collection records will include sampling procedures, the names of the persons conducting the activity, sample identification, equipment/method used, climatic conditions, and other observations as applicable.

3.3 Sample Milling and Transport to Analytical Laboratory

Samples will be transported to Hazen Research in Golden, Colorado (“Hazen”), to undergo milling prior to analysis. Each sample will be screened with a 2-millimeter (mm), No. 10 sieve. The portion which does not pass the sieve will be frozen in liquid nitrogen and milled to 2 mm using a Wiley knife mill, then recombined with the corresponding unmilled portion. Equipment decontamination will be performed prior to each sample. The standard operating procedure (SOP) implemented by Hazen is included in Appendix B. Milled treated and untreated MSR samples will be shipped to Eurofins Calscience (“Calscience”), an analytical laboratory located in Garden Grove, California.

3.4 Analytical Methods

Milled untreated and treated MSR samples submitted to Calscience will be analyzed for the following analytes:

- Cadmium, lead and zinc by EPA Method 6010/7471
- WET-leachable cadmium, lead, and zinc by EPA Method 6010 and CCR T22.11.5.A-II.
- Moisture content by ASTM D2216

Analytical methods, sample requirements, and reporting limits are presented in Table 1.

4.0 DATA EVALUATION AND REPORTING

4.1 Data Evaluation

4.1.1 Data Validation

Data validation reports will be prepared for each analytical laboratory report, in accordance with the procedures described in the QAPP. The analytical data will be reviewed and data validation reports will be prepared. Analytical data will be reviewed in general accordance with the principles for data validation presented in the U.S. Environmental Protection Agency (U.S. EPA) National Functional Guidelines for Organic Laboratory Data Review (U.S. EPA 2008) and the USEPA National Functional Guidelines for Inorganic Laboratory Data Review (U.S. EPA 2004). The data will be reviewed in the following areas to evaluate potential impact on data quality:

- Data Completeness;
- Analytical Holding Times and Sample Preservation;
- Field and Laboratory Blank Samples;
- Laboratory Control Samples;
- Matrix Spike/Matrix Spike Duplicate Samples;
- Surrogate Compound Recovery; and
- Compound Quantitation.

4.1.2 Comparison of Untreated Sample Results

The WET-leachable concentrations of cadmium, lead, and zinc from the eight untreated MSR samples collected on the first day of sampling at each facility will be compared with the results from the eight untreated samples collected on the second day of sampling at the same facility, using a statistical method, such as a *t*-test, performed at a confidence level of 95%. If the *t*-test indicates that the results for the two sets of untreated samples are not statistically different, the data will be pooled for evaluation. If the *t*-test indicates the two sets of data are statistically different, the two sets of data will be handled as separate datasets.

4.1.3 Comparison of Untreated and Treated MSR

The WET-leachable concentrations of cadmium, lead, and zinc from the untreated samples collected on each day (i.e., for each treatment dosage) from each facility will be compared with the WET-leachable concentrations of cadmium, lead, and zinc from the facility's corresponding treated samples collected on the same day. The concentrations will be compared using a statistical method, such as a *t*-test, performed at a confidence level of 95%.

The average and standard deviation will be calculated for each facility's set of treated and untreated sample results for each treatment dosage. The percent reduction from untreated to treated sample results will be calculated for each treatment dosage, for each facility.

4.1.4 Comparison of Results for Different Treatment Dosages

The WET-leachable concentrations of cadmium, lead, and zinc from samples treated with the two different treatment dosages applied at each facility will be compared with each other using a statistical method, such as a *t*-test, performed at a confidence level of 95%.

The average and standard deviation will be calculated for each facility's two sets of treated sample results. The percent difference between the results for the two treated sample sets will be calculated for each facility.

4.1.5 Calculation of 90% and 95% UCLs

The upper confidence limits (UCLs) will be calculated at confidence levels of 90% and 95% for each facility's treated sample results.

4.1.6 Data Screening Against Waste Classification Standards

The maximum, average and 95% UCL total and WET-leachable concentrations of cadmium, lead, and zinc for untreated and treated samples for each facility, and for each treatment dosage, will be compared with their respective TTLC and STLC values.

4.2 Reporting

The results of the pilot test will be presented in the Treatability Study Report ("TS Report"). The TS Report will include data from all phases of work, including Phases 1, 2, and 3 of the bench-scale treatability study, and the pilot test described herein. The TS Report will include a summary of sampling activities, laboratory procedures, field procedures, analytical results, data validation reports, and an evaluation of the results as discussed above.

5.0 SCHEDULE

The Pilot test will commence within two weeks of approval of this Work Plan by the DTSC. The work will be conducted according to the following timeline, assuming DTSC approval of the Work Plan is received by April 29, 2016:

Task	Estimated Completion Date
Collection of untreated and treated MSR samples at five facilities	5/20/2016
Sample milling completed	6/3/2016
Sample analysis completed	6/24/2016
Data validation and statistical evaluation completed	7/8/2016
Submittal of draft report to DTSC	8/5/2016

Adjustments to this schedule may need to be made to accommodate facility schedules, sample shipping times, laboratory turnaround times, and other considerations.

6.0 REFERENCES

Terraphase Engineering Inc. (Terraphase). 2014a. Metal Shredder Residue Treatability Study Work Plan. July.

_____. 2014b. Quality Assurance Project Plan, Metal Shredder Residue Treatability Study. Prepared for Institute of Scrap Metal Recycling Industries, California Chapter. August.

_____. 2014c. Sampling and Analysis Plan, Metal Shredder Residue Treatability Study. Prepared for Institute of Scrap Metal Recycling Industries, California Chapter. August.

U.S. Environmental Protection Agency (U.S. EPA). 2004. U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. Office of Solid Waste and Emergency Response. EPA 540-R-04-004.

_____. 2008. U.S. EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Data Review. Office of Solid Waste and Emergency Response. EPA 540-R-08-01.

TABLES

Table 1
Analytical Laboratory Methods, Sample Requirements, and Reporting Limits
MSR Treatability Study
DRAFT

Analyte	Method	Container	Minimum Sample Mass (g)	Preservation	Hold Time (days)	Reporting Limits*
Metals: cadmium, lead, zinc	EPA 6010/7471	glass jar or food-grade plastic container	2	None	180	0.5 - 1 mg/kg
Metals (WET): cadmium, lead, zinc	CCR T22.11.5.A-II/ EPA 6010	glass jar or food-grade plastic container	50	None	180 (after extraction)	0.1 mg/L
Moisture content	ASTM D2216	glass jar or food-grade plastic container	20	chill to 4 ± 2°C	10	0.1%

Notes:

*reporting limits may vary depending on matrix interference and dilution

°C = degrees Celsius

ASTM = American Society for Testing and Materials

CCR = California Code of Regulations

EPA = Environmental Protection Agency

g = gram

mg/kg = milligrams per kilogram

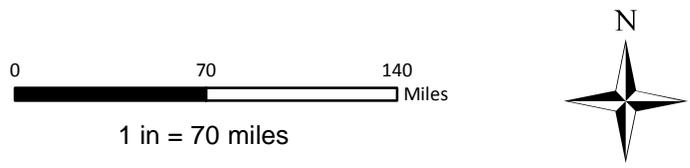
mL = milliliters

µg/kg = micrograms per kilogram

WET = Waste Extraction Test

FIGURES

File: J:\GIS Backup\GIS Data\0102_SRI\WMS\Figure1_Site_Loc_0102-001-001.mxd 3/14/2016 Created by: Initial Checked by: Initial Coordinate System: NAD 1983 StatePlane California III FIPS 0403 Feet



	CLIENT: Institute of Scrap Recycling Industries	Site Location Map
	PROJECT: MSR Treatability Study	
		PROJECT NUMBER: 0102.001.001

APPENDIX A
REAGENT SPECIFICATIONS

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: HP TREATMENT

CR 4823

MANUFACTURER'S NAME: C. C. I.

ADDRESS: 3540 EAST 26TH STREET, VERNON, CALIF 90058

EMERGENCY TEL NO : 800-424-9300

TEL NO FOR INFORMATION : 800-767-9112

DATE REVISED : 02/09/09

HAZARDOUS INGREDIENTS IDENTITY INFORMATION

Hazardous Components	CAS No	OSHA PEL	ACGH TLV	Other limits	%
Silicate	1312-76-1	N/Est	N/Est		5-10
<u>SARA Title III</u>	sec.302: Not listed				
	sec.313: listed	<u>Proposition 65:</u>	Not listed		
Phosphates	007320-34-5	5mg/m3 tp	N/Est		4-8
<u>SARA Title III</u>	sec.302: Not listed				
	sec.313: listed	<u>Proposition 65:</u>	Not listed		
Anionic & Cationic Surfactant Blend	Proprietary	N/Est	N/Est		10-15
<u>SARA Title III</u>	sec.302: Not listed				
	sec.313: listed	<u>Proposition 65:</u>	Not listed		

PHYSICAL CHEMICAL CHARACTERISTICS

Boiling Point : 212 °F

Vapor pressure : 23

Vapor Density : < 1

Solubility in Water : Complete

Specific Gravity : 1.07

Percent Volatile by volume (%) : NA

Melting Point : ND

Evaporation Rate : < 1

Reactivity in water :

pH: 11.2

Appearance and Odor : Clear, very slight amber liquid. No appreciable

FIRE AND EXPLOSION HAZARD DATA

Flash Point : None

Flammable limits : NA

LEL : NA

UEL : NA

Auto Ignition Temperature : NA

Extinguishing Media : Use any appropriate medium to extinguish surrounding fire.

Special Firefighting Procedures : None

Unusual Fire and Explosion Hazards : None

* *NA = Not Applicable*

HEALTH HAZARD DATA

Routes of Entry : Inhalation : Eyes : x Skin : Ingestion :

Acute Health Hazards :

INHALATION : Mist or sprays may cause chest discomfort and coughing

EYES : Direct contact may cause eye irritation

SKIN : Prolonged or repeated contact will remove body oils from skin causing slight irritation

INGESTION : May cause nausea and vomiting by swallowing large amounts of product

Chronic Health Hazards : None known

Signs and Symptoms of Exposure :

EYES : Slight irritation and watering of eyes

SKIN : Dryness from defatting skin, chapped hands

INHALATION : NA

INGESTION : Nausea and headache

Medical Conditions Generally Aggravated by Exposure : None known

EMERGENCY & FIRST AID PROCEDURES In all cases, contact physician immediately

INHALATION : Remove to fresh air. If irritation of respiratory system occurs or continues obtain medical attention

EYE CONTACT : Flush with running water for 15 minutes. If eye irritation occurs, obtain medical attention

SKIN CONTACT : Dry and defatted skin can result in dermatitis. If irritation persists obtain medical attention.

INGESTION : Give 2 glasses of water. Induce vomiting. Never give anything by mouth to an unconscious or convulsing person. obtain medical attention

TOXICITY DATA

Carcinogenicity : NO

NTP ? : NO IARC monographs ? : NO OSHA Regulated ? : NO

Oral : ND

Dermal : ND

Inhalation : ND

REACTIVITY DATA

Stability : Stable

Conditions to avoid : NA

Incompatibility (Materials to Avoid) : ND

Hazardous Decomposition or Byproducts : ND

Hazardous Polymerization : Will not occur

Conditions to avoid : NA

PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material is Released or Spilled :

SMALL SPILLS : Flush to drain with water

LARGE SPILLS : Dike materials to prevent run-off. Absorb spill with absorbent material and place in suitable container or pick up material with vacuum truck. Flush spill area with water to remove any residue. Notify local, state and federal officials as required

Waste Disposal Method : Material that cannot be used or chemically reprocessed should be disposed of at an approved facility in accordance with any applicable regulations under the Resource Conservation and Recovery Act. Since product is biodegradable and phosphate free, often times it can be disposed of in sewer.

Note: State and local regulations may be more stringent than federal.

Precautions to Be Taken in Handling and Storing : Store in a cool, dry place, keep from freezing, keep container tightly closed when not in use.

Other Precautions : For industrial and institutional use only. Keep out of reach of children.

CONTROL MEASURES

Respiratory protection (Specify type) : None needed.

Ventilation : General room

Local Exhaust : None

Mechanical : None

Protective Gloves : None needed

Eye Protection : Safety glasses where splashing may occur

Other Protective Clothing or Equipment : None

Work Hygienic Practices : The recommendations described in this section are provided as general guidance for minimizing exposure when handling this product. Because use conditions will vary depending upon customer use conditions. Specific use safe handling should be developed by person knowledgeable of the intended use conditions and equipment.

DOT HAZARDOUS INFORMATION

UN/NA : NA

Classification : NA

Proper Shipping Name : INDUSTRIAL WATER TREATMENT COMPOUND, NON D.O.T.
REGULATED.

HMIS HEALTH RATING: 0-INSIGNIFICANT 1-SLIGHT, 2-MODERATE, 3-HIGH, 4-
EXTREME

HMIS RATING FOR THIS PRODUCT:

TOXICITY : 1

FIRE : 0

REACTIVITY : 0

NOTICE

All information, recommendations, and suggestions appearing herein concerning this product are based upon data obtained from the manufacturer and/or recognized technical sources; however, C.C.I. makes no warranty, representation or guaranty as to the accuracy, sufficiency or completeness of the material set forth herein. It is the user's responsibility to determine the safety, toxicity and suitability of his own use, handling and disposal of the product. Additional product literature may be available upon request. Since actual use by others is beyond our control, no warranty, express or implied is made by C.C.I. as to the effects of such use, the results to be obtained or the safety and toxicity of the product nor does C.C.I. assume any liability arising out of use by others of this product.

MATERIAL SAFETY DATA SHEET

Date Revised: 02/13/2007

I. PRODUCT IDENTIFICATION

IDENTITY: PV Cement

Classification:
Silica Reactive Cement,
Cement Stabilizer

Manufacturer: DIVERSIFIED MINERALS INC.
1135 E. Wooley Rd.
Oxnard CA, 93030
(805) 247-1069 - Toll Free (888) 364-9595

Poison Center: (800) 356-3129

II. PRODUCT FORMULA/INGREDIENTS

<u>Major Constituents:</u>	<u>CAS Numbers:</u>	<u>TLV</u>
3CaO-SiO ₂	11168-85-3	5 mg/m ³
2CaO-SiO ₂	10034-77-2	5 mg/m ³
3CaO-Al ₂ O ₃ -Fe ₂ O ₃	12042-78-3	5 mg/m ³
4CaO-Al ₂ O ₃ -Fe ₂ O ₃	12068-35-8	5 mg/m ³
CaSO ₄ -0.5H ₂ O	13397-24-5	5 mg/m ³
Ca(OH) ₂	37247-91-9	5 mg/m ³

Trace Elements: Trace amounts of naturally occurring materials might be detected during chemical analysis. Such as small amounts of MgO, K₂OSO₄, CaO and Na₂SO₄ may be present.

III. PHYSICAL DATA

Odor and Appearance:	Wet stone odor, gray fine powder.		
Boiling Point:	Not applicable	Evaporation Rate:	Not applicable
Vapor Pressure:	Not applicable	Specific Grav. (H ₂ O = 1):	3.1
Water Solubility:	Slight (0.1 - 1.0%)	Melting Point:	Not available
Vapor Density (Air = 1):	Not applicable	Volatile by Volume:	0%
pH of Saturated Solution:	Approximately 12.0	Est. weight (per 1/ft ³):	80 - 94 lb/ft ³

IV. FIRE AND EXPLOSION DATA

Flash Point:	Not applicable
Flammable Limits:	Not applicable
Flammable/Combustible Liquid Classifications:	Not applicable
Extinguishing Media:	Not applicable
Unusual Fire or Explosion Hazards:	None
Auto-Ignition Temperature:	Not applicable
Special Fire-Fighting Procedures:	Not applicable

MATERIAL SAFETY DATA SHEET

V. HEALTH HAZARDS

SUMMARY: Inhalation of dust should be avoided. The constituents may cause irritation of eyes, skin, and respiratory tract. Ingestion may cause irritation of gastrointestinal tract.

Threshold Limit Value (TLV): Respirable Dust - 2 mg/m³. Total Dust - 10 mg/m³. 30 million Particles/ft³.

Acute Health Effects: Irritation of eyes, skin, nose, throat, and upper respiratory tract.

Primary Entry Routes: Inhalation or ingestion.

VI. REACTIVITY DATA

Chemical Incompatibility: Strong acids and Fluorine.

Decomposition Products: Oxides and Carbon Dioxide.

VII. SPILL OR LEAK PROCEDURES

Procedures for Spills: Avoid creation of excessive dust. Wear appropriate personal protective equipment as described in Section VIII, if potential for exposure to excessive dust concentrations.

Waste Management: Use for intended purpose, if possible, otherwise material should be disposed of in accordance with all federal, state, and local regulatory requirements. Take appropriate precautions to prevent excessive exposure to dust by transport or disposal site personnel.

VIII. SPECIAL PROTECTION INFORMATION

Goggles: Tight-fitting safety goggles should be worn by persons handling this material where ventilation is inadequate.

Skin Protection: Use barrier creams, gloves, boots and clothing to protect the skin from prolonged contact.

Respirator: An appropriate NIOSH approved respirator should be worn where ventilation is inadequate or dust concentration may exceed TLV.

Ventilation: Use local or general exhaust ventilation to keep dust levels as low as possible.

Other: Engineering controls and operating procedures should be designed to reduce airborne dust concentrations to a minimum.

MATERIAL SAFETY DATA SHEET

IX. SPECIAL PRECAUTIONS

Storage Segregation Hazard Classes:	Alkaline
Special Handling Storage:	Avoid storage with incompatible materials noted in Section VI.
Special Workplace Engineering Controls:	Work practices should minimize dust. Refer to Section VIII.

X. ABBREVIATIONS

OSHA - Occupational Safety & Health Administration	NTP - National Toxicology Program
NIOSH - National Institute for Occupational Safety & Health	CAS - Chemical Abstract Service
IARC - International Agency of Research on Cancer	TLV - Threshold Limit Values

Disclaimer of Liability Notice and Prop. 65 Notice:

This MSDS was prepared, and is to be used only for this product. If this product is used as a component to, or in association with other product(s), or processes, this MSDS information may not be applicable. It is the responsibility of the User(s), or Final Recipient(s) of this product, to distribute this MSDS to employees and personnel.

The conditions or methods of handling, storage, and use of this product are beyond our control and may be beyond our knowledge. FOR THIS AND OTHER REASONS, DMI AND ASSOCIATED COMPANIES DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS OR DAMAGE, OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH THE HANDLING, STORAGE, OR USE OF THIS PRODUCT.

While PV Cement is not listed as a carcinogen by NTP, IARC, or OSHA. It may, however, contain trace metal compounds are listed on the NTP and IARC lists of carcinogens.

Proposition 65 Notice: **WARNING:** This product or area of its manufacture contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

NIOSH conducted a study, "The mortality of U.S. Portland Cement and Quarry Workers" (March 1985) which found: "There is no excess mortality from all causes of death, lung cancer, non-malignant respiratory disease, or ischemic heart disease" among workers studied.

This Warning required by section 25249.6 of the California Health and Safety Code.

Prepared by: Diversified Minerals Inc., Technical Services Dept.

Telephone #: (888) DMI-9595



SAFTEY DATA SHEET

Date prepared _____

Manufacturer: Envirokem Engineering Services, Inc.
 4670 East Waterloo road
 Stockton, CA 95205

Emergency Telephone Number: 925-683-0838, 209-365-7833

1. Product Description:

Product Name:	METABOND MCX-90, N,R
Chemical Description:	Proprietary Blend
Synonyms:	None

2. Hazardous Ingredients:

Chemicals :	CAS Number	Wt. %	OSHA PEL	ACGIH TLV
Water:	7732-18-5 <10		Not Established	Not Established
Silicic Acid, Sodium Salt:	1344.09-8 >70		Not Established	Not Established
Proprietary Ingredients:	>20		Not Established	Not Established

3. Physical and Chemical Properties:

Appearance:	Viscous liquid
Color:	Red to Hazy Liquid
Odor:	Odorless or Musty Odor
PH:	Approximately 12.3
PH (1% aqueous solution):	Approximately 10.9
Specific Gravity & 25 C:	1.49
Solubility in Water:	Completely Soluble
Freezing Point:	Not Determined
Vapor Pressure @ 20.C:	Not Determined
Vapor Density:	Not Determined

4. Health and First Aid Data:

Acute Effects of Overexposure

Ingestion:	May cause irritation to mouth, esophagus, stomach and gastrointestinal tract.
Skin Absorption:	None currently known
Inhalation:	No health effects are known to occur from inhalation of this product. Inhalation of mist or spray may result in irritation to respiratory tract.
Eye Contact:	Slightly hazardous in case of eye contact (irritant)
Skin Contact:	Slightly hazardous in case of skin contact (irritant) Non-sensitizer for skin. Skin inflammation is characterized by itching, scaling, reddening or occasionally blistering
Chronic Effects of: Overexposure:	No chronic effects, either systemic or local are known. Not listed by NTP, IARC or OSHA as carcinogen.
Other Health Hazards:	None currently known.

Emergency and First aid Procedure

Skin:	In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Wash with water until material has been removed. Get medical attention.
Eyes:	Immediately flush eyes with plenty of water for at least 15 minutes If easy to do, remove contact lenses, if worn. Hold eyelids apart To ensure complete flushing. Do not attempt to neutralize with Chemical agents. Get medical attention.
Inhalation:	Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion:	If swallowed, DO NOT induce vomiting. Get medical attention Immediately. If victim is fully conscious, give a cupful of water. Never give anything by mouth to an unconscious person.

5. Fire and Explosion Hazard:

Flammable limits:	This material is noncombustible.
Extinguishing Media:	This material is compatible with all extinguishing media.
Hazard to fire-fighters:	Spilled material is very slippery. Dries to form glass film which Easily cuts skin.
Unusual Fire & Explosion Hazard:	None currently known.
Fire-fighting equipment:	The following protective equipment is recommended when this Material is present in the area of a fire: Chemical goggles, body- Covering protective clothing, chemical resistant gloves, rubber Boots and self-contained breathing devices equipped with full Face piece.

6. Reactivity Data:

Stability:	This material is stable under all conditions of use and storage.
Condition to avoid:	None.
Material to avoid:	Generates heat when mixed with acid. May react with ammonia Salts resulting in evolution of ammonia gas. Flammable hydrogen Gas may be produced on contact with aluminum, tin, lead and zinc.
Hazardous decomposition:	Hydrogen Carbon disulfide and dimethylamine may be generated
Products:	upon acidification.

7. Spill and Disposal Procedure:

Environmental Fate	This material is not persistent in aquatic systems, but its high ph When undiluted or un-neutralized is acutely harmful to aquatic life.
Small Spills	Absorb liquid with absorbent material.
Large Spills	Stop spill at source. Dike area of the spill to prevent spreading. Pump liquids into waste container. Remaining liquids can be absorbed.
Classification	Disposed material is not hazardous waste.
Disposal Method	Neutralize and landfill solids in accordance with federal, state and local regulations. Flush neutral liquid to sewer in accordance with federal, state and local regulations and permits.

8. Exposure Controls / Personal Protection:

Respiratory Protection:	Use a NIOSH-approved dust and mist respirator where spray mist occurs. Observe OSHA regulations for respirator use (29 C.F.R. 1910.134).
Skin Protection:	Wear body-covering protective clothing and gloves.
Eye Protection:	Contact lenses should not be used. Wear chemical goggles or face shield where contact with liquid is likely.
Engineering Control:	Use with adequate ventilation. Keep containers closed. Safety Showers and eyewash fountain should be within direct access.

9. Special Precautions:

Product Storing and Handling:	Do not get in eyes, on skin or on clothing. Wash thoroughly after handling. Soiled clothing should be removed and laundered before use. Do not store product at high temperature or below freezing. Keep containers closed when not in use. Protect containers from physical damage.
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10. TRANSPORTATION INFORMATION:

DOT UN shipping regulation: Not regulated as hazardous material for transportation.

11. Regulatory Information:

SARA (Superfund Amendments and Reauthorization Act)

SARA 302: No components of this product are listed.
SARA 312: Immediate (Acute) Health Hazard.
SARA 313: Not a toxic chemical.

CERCLA (Comprehensive Environmental Response and Liability Act)

CERCLA: No components of this product are present above the
De minimus levels.

TSCA (Toxic Substances Control Act) Applicability

TSCA: All components of this product are listed on the TSCA inventory.

FDA (Food and Drug Administration)

FDA: This product is not approved for food contact uses.

12. Special Precautions:

Handling and Storing: Do not get in eyes, on skin or on clothing. Wash thoroughly after
handling. Soiled clothing should be removed and laundered before
reuse. Store below 120 F.

The information on the Safety Data Sheet is believed to be accurate obtained from the manufacturer and/or recognized technical sources available to ENVIROKEM. This document is intended only as a guide to the appropriate precautions for handling a chemical by a person trained in chemical handling. ENVIROKEM makes no warranty whatsoever expressed or implied of merchantability of fitness for the particular purpose regarding the accuracy of such data or the results to be obtained from the use thereof. ENVIROKEM assumes no liability and responsibility for injury to recipient or third persons or for any damage to any property and recipient assumes all such risks.

Safety Data Sheet **Portland Cement**

Section 1. Identification

GHS product identifier:	Portland Cement
Chemical name:	Calcium compounds, calcium silicate compounds, and other calcium compounds containing iron and aluminum make up the majority of this product.
Other means of identification:	Cement, ASTM Type I, II, III, V, Portland Limestone Cement, Plastic Cement, Hydraulic Cement, Oilwell Cement, Well Cement, Class G Cement, InterCem, Type L, CSA Type GU, GUb, GUL, MS, MH, MHL, HE, HEL, LH, LHL, HS
Relevant identified uses of the substance or mixture and uses advised against:	Building materials, construction, a basic ingredient in concrete.
Supplier's details:	300 E. John Carpenter Freeway, Suite 1645 Irving, TX 75062 (972) 653-5500
Emergency telephone number (24 hours):	CHEMTREC: (800) 424-9300

Section 2. Hazards Identification

Overexposure to portland cement can cause serious, potentially irreversible skin or eye damage in the form of chemical (caustic) burns, including third degree burns. The same serious injury can occur if wet or moist skin has prolonged contact exposure to dry portland cement.

OSHA/HCS status:	This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
Classification of the substance or mixture:	SKIN CORROSION/IRRITATION – Category 1 SERIOUS EYE DAMAGE/EYE IRRITATION – Category 1 SKIN SENSITIZATION – Category 1 CARCINOGENICITY/INHALATION – Category 1A SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) [Respiratory tract irritation] – Category 3

GHS label elements

Hazard pictograms:



Signal word:

Danger

Hazard statements:

Causes severe skin burns and eye damage.
May cause an allergic skin reaction.
May cause respiratory irritation.
May cause cancer.

Precautionary statements:

Prevention:

Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not breathe dust. Use outdoors in a well ventilated area. Wash any exposed body parts thoroughly after handling. Wear protective gloves/protective clothing/eye protection/face protection. Contaminated clothing must not be allowed out of the workplace.

Response:

If exposed or concerned: Immediately get medical advice/attention if you feel unwell or irritation or rash occurs. If on skin: Wash with plenty of water. Take off contaminated clothing and wash it before reuse. If in eyes: Rinse continuously with water for several minutes. Remove contact lenses, if present and easy to do. If inhaled: Remove person to fresh air and keep comfortable for breathing. If swallowed: Rinse mouth. Do not induce vomiting.

Storage:

Restrict or control access to stockpile areas (store locked up). Engulfment hazard: To prevent burial or suffocation, do not enter a confined space, such as a silo, bulk truck or other storage container or vessel that stores or contains cement without an effective procedure for assuring

Disposal:	safety. Store in a well ventilated area. Keep container tightly closed. Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazards not otherwise classified (HNOC):	None known
Supplemental Information:	Respirable Crystalline Silica (RCS) may cause cancer. Repeated inhalation of respirable crystalline silica (quartz) may cause lung cancer according to IARC and NTP; ACGIH states that it is a suspected cause of cancer. Other forms of RCS (e.g., tridymite and cristobalite) may also be present or formed under certain industrial processes.

Section 3. Composition/information on ingredients

Substance/mixture:	Mixture
Chemical Name:	Calcium compounds, calcium silicate compounds, and other calcium compounds containing iron and aluminum make up the majority of this product.

CAS number/other identifiers

Ingredient name	%	CAS number
Portland Cement	100%	65997-15-1
The structure of Portland cement may contain the following in some concentration ranges:		
Calcium oxide	A-B	1305-78-8
Quartz	C-D	14808-60-7
Hexavalent chromium*	E-F	18450-29-9
Portland cement also contains gypsum, limestone and magnesium oxide in various concentrations. However, because these components are not classifiable as a hazard under Title 29 Code of Federal Regulations 1910.1200, they are not required to be listed in this section.		
Gypsum	G-H	13397-24-5
Limestone	I-J	1317-65-3
Magnesium oxide	K-L	1309-48-4

Any concentration shown as a range is to protect confidentiality or is due to process variation.

*Hexavalent chromium is included due to dermal sensitivity associated with the component.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye Contact:	Get medical attention immediately. Call a poison center or physician. Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 20 minutes. Chemical burns must be treated promptly by a physician.
Inhalation:	Seek medical help if coughing or other symptoms persist. Inhalation of large amounts of portland cement requires immediate medical attention. Call a poison center or physician. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If the individual is not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. If unconscious, place in a recovery position and get medical attention immediately. Maintain an open airway.
Skin Contact:	Get medical attention immediately. Heavy exposure to portland cement dust, wet concrete or associated water requires prompt attention. Quickly remove contaminated clothing, shoes, and leather goods such as watchbands and belts. Quickly and gently blot or brush away excess portland cement. Immediately wash thoroughly with lukewarm, gently flowing water and non-abrasive pH natural soap. Seek medical attention for rashes, burns, irritation, dermatitis and prolonged unprotected exposure to wet cement, cement mixtures or liquids from wet cement. Burns should be treated as caustic burns. Portland cement causes skin burns with little warning. Discomfort or pain cannot be relied upon to alert a person to

a serious injury. You may not feel pain or the severity of the burn until hours after the exposure. Chemical burns must be treated promptly by a physician. In the event of any complaints or symptoms, avoid further exposure. Get medical attention immediately. Call a poison center or physician. Have victim rinse mouth thoroughly with water. DO NOT INDUCE VOMITING unless directed to do so by medical personnel. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Have victim drink 60 to 240 mL (2 to 8 oz.) of water. Stop giving water if the exposed person feels sick as vomiting may be dangerous. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Chemical burns must be treated promptly by a physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

Ingestion:

Most important symptoms/effects, acute and delayed potential acute health effects

Eye contact: Causes serious eye damage.
Inhalation: May cause respiratory irritation.
Skin contact: Causes severe burns. May cause an allergic skin reaction.
Ingestion: May cause burns to mouth, throat and stomach.

Over-exposure signs/symptoms

Eye contact: Adverse symptoms may include the following: pain, watering and redness.
Inhalation: Adverse symptoms may include the following: respiratory tract irritation and coughing.
Skin contact: Adverse symptoms may include the following: pain or irritation, redness and blistering may occur, skin burns, ulceration and necrosis may occur.
Ingestion: Adverse symptoms may include the following: stomach pains.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician: Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.
Specific treatments: Not applicable.
Protection of first-aiders: No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media: Use an extinguishing agent suitable for the surrounding fire.
Unsuitable extinguishing media: Do not use water jet or water-based fire extinguishers.
Specific hazards arising from the chemical: No specific fire or explosion hazard.
Hazardous thermal decomposition Products: Decomposition products may include the following materials: carbon dioxide, carbon monoxide, sulfur oxides and metal oxide/oxides.
Special protective actions for fire-fighters: Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.
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.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel: No action shall be taken involving any personal risk or without suitable training. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Do not

**For emergency responders:
Environmental precautions:**

breathe dust. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.
For personal protective clothing requirements, please see Section 8.
Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has entered the environment, including waterways, soil or air. Materials can enter waterways through drainage systems.

Methods and materials for containment and cleaning up

Small spill:

Move containers from spill area. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place in a closed, labeled waste container. Place spilled material in a designated, labeled waste container. Dispose of waste material by using a licensed waste disposal contractor.

Large spill:

Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Avoid dust generation. Do not dry sweep. Vacuum dust with equipment fitted with a HEPA filter and place dust in a closed, labeled waste container. Avoid creating dusty conditions and prevent wind dispersal. Large spills to waterways may be hazardous due to alkalinity of the product. Dispose of waste material using a licensed waste disposal contractor. Note: see section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures:

Put on appropriate personal protective equipment (see Section 8). Persons with a history of skin sensitization problems should not be employed in any process in which this product is used. Avoid exposure by obtaining and following special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe dust. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material and keep the container tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene:

Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities:

A key to using the product safely requires the user to recognize that portland cement reacts chemically with water to produce calcium hydroxide which can cause severe chemical burns. Every attempt should be made to avoid skin and eye contact with cement. Do not get portland cement inside boots, shoes or gloves. Do not allow wet, saturated clothing to remain against the skin. Promptly remove clothing and shoes that are dusty or wet with cement mixtures. Launder/clean clothing and shoes before reuse. Do not enter a confined space that stores or contains portland cement unless appropriate procedures and protection are available. Portland cement can build up or adhere to the walls of a confined space and then release or fall suddenly (engulfment).

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
-----------------	-----------------

<p>Cement, portland, chemicals</p>	<p>ACGIH TLV (United States, 3/2012) TWA: 1 mg/m³ 8hours. Form: Respirable fraction</p> <p>NIOSH REL (United States, 6/2009) TWA: 5 mg/m³ 10 hours. Form: Respirable fraction TWA: 10 mg/m³ 10 hours. Form: Total</p> <p>OSHA PEL (United States, 6/2010) TWA: 5mg/m³. 8 hours. Form: Respirable fraction TWA: 15 mg/m³. 8 hours. Form: Total dust</p>
<p>Calcium oxide</p>	<p>ACGIH TLV (United States, 3/2012) TWA: 2 mg/m³ 8 hours</p> <p>NIOSH REL (United States, 6/2009) TWA: 2mg/m³ 10 hours.</p> <p>OSHA PEL (United States, 6/2010) TWA: 5 mg/m³ 8 hours.</p>
<p>Limestone</p>	<p>NIOSH REL (United States, 6/2009) TWA: 5 mg/m³ 10 hours. Form: Respirable fraction TWA: 10 mg/m³ 10 hours. Form: Total</p> <p>OSHA PEL (United States, 6/2010) TWA: 5 mg/m³ 8 hours. Form: Respirable fraction TWA: 15 mg/m³ 8 hours. Form: Total dust</p>
<p>Magnesium oxide</p>	<p>ACGIH TLV (United States, 3/2012) TWA: 10 mg/m³ 8 hours. Form: Inhalable fraction</p> <p>OSHA PEL (United States, 6/2010) TWA: 15 mg/m³ 8 hours. Form: Total particulates</p>
<p>Quartz</p>	<p>ACGIH TLV (United States, 3/2012) TWA: 0.025 mg/m³ 8 hours. Form: Respirable fraction</p> <p>NIOSH REL (United States, 6/2009) TWA: 0.05 mg/m³ 10 hours. Form: Respirable dust</p> <p>OSHA PEL Z-3 (United States, 9/2005) TWA: 10 mg/m³ divided by % SiO₂ + 2: Respirable TWA: 30 mg/m³ divided by % SiO₂ + 2: Total</p>
<p>Calcium sulfate (gypsum)</p>	<p>ACGIH TLV (United States, 3/2012) TWA: 10 mg/m³ 8 hours. Form: Respirable fraction</p> <p>NIOSH REL (United States, 6/2009) TWA: 5 mg/m³ 8 hours. Form: Respirable fraction TWA: 10 mg/m³ 8 hours. Form: Total dust</p> <p>OSHA PEL Z-1 (United States, 2/2006) TWA: 5 mg/m³ 8 hours. Form: Respirable fraction TWA: 15 mg/m³ 8 hours. Form: Total dust</p>

Appropriate engineering controls:

Use only with adequate ventilation. If user operations generate dust, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls:

Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation.

Individual protection measures

Hygiene measures:	Clean water should always be readily available for skin and (emergency) eye washing. Periodically wash areas contacted by portland cement with a pH neutral soap and clean, uncontaminated water. If clothing becomes saturated with portland cement, garments should be removed and replaced with clean, dry clothing.
Eye/face protection:	To prevent eye contact, wear safety glasses with side shields, safety goggles or face shields when handling dust or wet cement. Wearing contact lenses when working with cement is not recommended.

Skin protection

Hand protection:	Use impervious, waterproof, abrasion and alkali-resistant gloves. Do not rely on barrier creams in place of impervious gloves. Do not get portland cement inside gloves.
Body protection:	Use impervious, waterproof, abrasion and alkali-resistant boots and protective long-sleeved and long-legged clothing to protect the skin from contact with wet portland cement. To reduce foot and ankle exposure, wear impervious boots that are high enough to prevent portland cement from getting inside them. Do not get portland cement inside boots, shoes, or gloves. Remove clothing and protective equipment that becomes saturated with cement and immediately wash exposed areas of the body.
Other skin protection:	Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved.
Respiratory protection:	Use properly fitted, particulate filter 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 assigned protection factor of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical State:	Solid. [Powder]	Lower and Upper explosive flammable limits	Not applicable
Color:	Gray or white	Vapor pressure:	Not applicable
Odor:	Odorless	Vapor density:	Not applicable
Odor threshold:	Not available	Relative density:	2.3 to 3.1
pH:	>11.5 [Conc. (% w/w): 1%]	Solubility:	Slightly soluble in water
Melting point:	Not available	Solubility in water:	0.1 to 1%
Boiling point:	>1000°C (>1832°F)	Partition coefficient: n-octanol/water:	Not applicable
Flash point:	Not flammable. Not combustible	Auto-ignition temperature:	Not applicable
Burning time:	Not available	Decomposition temperature:	Not available
Burning rate:	Not available	SADT:	Not available
Evaporation Rate:	Not applicable	Viscosity:	Not applicable
Flammability (solid, gas):	Not applicable		

Section 10. Stability and reactivity

Reactivity:	Reacts slowly with water forming hydrated compounds, releasing heat and producing a strong alkaline solution until reaction is substantially complete.
Chemical Stability:	The product is stable.
Possibility of hazardous reactions:	Under normal circumstances of storage and use, hazardous reactions will not occur.
Conditions to avoid:	No specific data.
Incompatible materials:	Reactive or incompatible with the following materials: oxidizing materials, acids, aluminum and ammonium salt. Portland cement is highly alkaline and will react with acids to produce a violent, heat-generating reaction. Toxic gases or vapors may be given off depending on the acid involved. Reacts with acids, aluminum metals and ammonium salts. Aluminum powder and other alkali and alkaline earth elements will react in wet mortar or concrete, liberating hydrogen gas. Limestone ignites on contact with fluorine and is incompatible with acids, alum, ammonium salts, and magnesium. Silica reacts violently with powerful oxidizing agents such as fluorine, boron trifluoride, chlorine trifluoride, manganese trifluoride, and oxygen difluoride yielding possible fire and/or explosions. Silicates dissolve readily in hydrofluoric acid producing a corrosive gas-silicon tetrafluoride.
Hazardous decomposition products:	Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity: Portland Cement LD50/LC50 = Not available
Irritation/Corrosion: **Skin:** May cause skin irritation. May cause serious burns in the presence of moisture.
Eyes: Causes serious eye damage. May cause burns in the presence of moisture.
Respiratory: May cause respiratory tract irritation.
Sensitization: May cause sensitization due to the potential presence of trace amounts of hexavalent chromium.
Mutagenicity: There are no data available.

Carcinogenicity:
 Classification below:

Product/ingredient name	OSHA	IARC	ACGIH	NTP
Cement, portland, chemicals	-	-	A4	-
Quartz	-	1	A2	Known to be a human carcinogen.

Reproductive toxicity: There are no data available.
Teratogenicity: There are no data available.

Specific target organ toxicity (single exposure)

Name	Category	Route of Exposure	Target Organs
Calcium oxide	Category 3	Inhalation and skin contact	Respiratory tract irritation, skin irritation
Cement, portland, chemicals	Category 3	Inhalation and skin contact	Respiratory tract irritation, skin irritation

Specific target organ toxicity (repeated exposure)

Name	Category	Route of Exposure	Target Organs
Quartz	Category 1	Inhalation	Respiratory tract and kidneys

Aspiration hazard: There are no data available.

Information on the likely routes of exposure

Potential acute health effects: **Eye contact:** Causes serious eye damage.
Inhalation: May cause respiratory irritation.
Skin contact: Causes severe burns. May cause an allergic skin reaction.
Ingestion: May cause burns to mouth, throat and stomach.

Symptoms related to the physical, chemical and toxicological characteristics: **Eye contact:** Adverse symptoms may include the following: pain, watering, redness.
Inhalation: Adverse symptoms may include the following: respiratory tract irritation, coughing
Skin contact: Adverse symptoms may include the following: pain or irritation, redness, blistering may occur, skin burns, ulcerations and necrosis may occur
Ingestion: Adverse symptoms may include the following: stomach pains

Delayed and immediate effects and also chronic effects from short and long term exposure: **Short term exposure**
 Potential immediate effects: No known significant effects or critical hazards.
 Potential delayed effects: No known significant effects or critical hazards.

Long term exposure
 Potential immediate effects: No known significant effects or critical hazards.

Potential chronic health effects: Potential delayed effects: No known significant effects or critical hazards.
General: Repeated or prolonged inhalation of dust may lead to chronic respiratory irritation. If sensitized to hexavalent chromium, a severe allergic dermal reaction may occur when subsequently exposed to very low levels.

Carcinogenicity: Portland cement is not classifiable as a human carcinogen. Crystalline silica is considered a hazard by inhalation. IARC has classified crystalline silica as a Group 1 substance, carcinogenic to humans. This classification is based on the findings of laboratory animal studies (inhalation and implantation) and epidemiology studies that were considered sufficient for carcinogenicity. Excessive exposure to crystalline silica can cause silicosis, a non-cancerous lung disease.

Mutagenicity: No known significant effects or critical hazards.

Teratogenicity: No known significant effects or critical hazards.

Developmental effects: No known significant effects or critical hazards.

Fertility effects: No known significant effects or critical hazards.

Numerical measures of toxicity: Acute toxicity estimates: There are no data available.

Section 12. Ecological Information

Toxicity

Product/ingredient name	Result	Species	Exposure
Calcium oxide	Chronic NOEC 100 mg/L Fresh water	Fish-Oreochromis niloticus-Juvenile (Fledgling, Hatchling, Weanling)	46 days

Persistence and degradability: There are not data available.
Bioaccumulative potential: There are not data available.
Mobility in soil: Soil/water partition coefficient (Koc): Not available.
Other adverse effects: No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods: The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Untreated waste should not be released to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe manner. Care should be taken when handling empty containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff, and contact with soil, waterways, drains and sewers.

Section 14. Transportation information

	DOT Classification	IMDG	IATA
UN number	Not regulated	Not regulated	Not regulated
UN proper shipping name	-	-	-
Transport hazard class(es)	-	-	-
Packing group	-	-	-
Environmental hazards	None	None	None
Additional information	-	-	-

Special precautions for user: Transport within user's premises: always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: Not available.

Section 15. Regulatory Information

TSCA 6 final risk management: Chromium, ion (Cr6+)
United States inventory (TSCA 8b): Cements are considered to be statutory mixtures under TSCA. CAS 65997-15-1 is included on the TSCA inventory.
CERCLA: This product is not listed as a CERCLA substance
Clean Air Act Section 112 (b): Hazardous Air Pollutants (HAPs) – Not listed
Clean Air Act Section 602: Class I Substances - Not listed
Clean Air Act Section 602: Class II Substances - Not listed
DEA List I Chemicals: (Precursor Chemicals) – Not listed
DEA List II Chemicals: (Essential Chemicals) – Not listed

SARA 311/312

Classification: Immediate (acute) health hazard
 Delayed (chronic) health hazard

Composition/information on ingredients

Name	%	Fire Hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
Calcium oxide	A-B	No	No	No	Yes	No
Quartz	>0.1	No	No	No	No	Yes
Chromium, ion (Cr6+)	<0.1	No	No	No	Yes	Yes

SARA 313

	Product name	CAS number	%
Form R-Report requirements	Chromium, ion (Cr6+)	8540-29-9	<0.1

State regulations

Massachusetts: The following components are listed: cement, portland, chemicals, limestone
New York: None of the components are listed.
New Jersey: The following components are listed: cement, portland, chemicals, gypsum, limestone
Pennsylvania: The following components are listed: cement, portland, chemicals, gypsum, limestone

California Prop. 65

WARNING: This product contains crystalline silica and chemicals (trace metals) known to the State of California to cause cancer, birth defects or other reproductive harm. California law requires the above warning in the absence of definitive testing to prove the defined risks do not exist.

Ingredient name	Cancer	Reproductive	No significant risk level	Maximum acceptable dosage level
Quartz	Yes	No	No	No
Chromium, ion (Cr6+)	Yes	Yes	0.001µg/day (inhalation)	8.2 micrograms/day (ingestion)

International regulations

International lists: **Canadian Domestic Substances List (DSL):** Portland cement is included on the DSL.
Mexico Inventory (INSQ): All components are listed or exempted.

Section 16. Other Information

Date of issue: 06/01/2015
Version: 06/01/2015
Revised Section(s): N/Ap

Notice to reader

While the information provided in this safety data sheet is believed to provide a useful summary of the hazards of portland cement as it is commonly used, the sheet cannot anticipate and provide all of the information that might be needed in every situation. Inexperienced product users should obtain proper training before using this product. In particular, the data furnished in this sheet do not address hazards that may be posed by other materials mixed with portland cement to produce portland cement products. Users should review other relevant material safety data sheets before working with this portland cement or working on portland cement products, for example, portland cement concrete.

SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, CONCERNING THE PRODUCT OR THE MERCHANTABILITY OR FITNESS THEREOF FOR ANY PURPOSE OR CONCERNING THE ACCURACY OF ANY INFORMATION PROVIDED BY Lehigh Hanson, except that the product shall conform to contracted specifications. The information provided herein was believed by the Lehigh Hanson to be accurate at the time of preparation or prepared from sources believed to be reliable, but it is the responsibility of the user to investigate and understand other pertinent sources of information to comply with all laws and procedures applicable to the safe handling and use of product and to determine the suitability of the product for its intended use. Buyer's exclusive remedy shall be for damages and no claim of any kind, whether as to product delivered or for non-delivery of product, and whether based on contract, breach of warranty, negligence, or otherwise shall be greater in amount than the purchase price of the quantity of product in respect of which damages are claimed. In no event shall Seller be liable for incidental or consequential damages, whether Buyer's claim is based on contract, breach of warranty, negligence or otherwise.

Abbreviations

ACGIH — American Conference of Governmental Industrial Hygienists
CAS — Chemical Abstract Service
CERCLA — Comprehensive Emergency Response and Comprehensive Liability Act
CFR — Code of Federal Regulations
DOT — Department of Transportation
GHS — Globally Harmonized System
HEPA — High Efficiency Particulate Air
IATA — International Air Transport Association
IARC — International Agency for Research on Cancer
IMDG — International Maritime Dangerous Goods
NIOSH — National Institute of Occupational Safety and Health
NOEC — No Observed Effect Concentration
NTP — National Toxicology Program
OSHA — Occupational Safety and Health Administration
PEL — Permissible Exposure Limit
REL — Recommended Exposure Limit
RQ — Reportable Quantity
SARA — Superfund Amendments and Reauthorization Act
SDS — Safety Data Sheet
TLV — Threshold Limit Value
TPQ — Threshold Planning Quantity
TSCA — Toxic Substances Control Act
TWA — Time-Weighted Average
UN — United Nations



LEHIGH SOUTHWEST CEMENT COMPANY
MATERIAL SAFETY DATA SHEET
FOR
PORTLAND CEMENT

REVISED DATE: August, 2009

1. PRODUCT/COMPANY IDENTIFICATION

Supplier:
Lehigh Southwest Cement Company
12667 Alcosta Blvd. #400
San Ramon, CA 94583
Phone (925) 244-6500
Fax (925) 244-6525
Contact Number:
(USE SALES OFFICE PHONE NUMBER)

Chemical Family: Calcium Compounds

Chemical Name and Synonyms:
Portland Cement (CAS # 65997-15-1), Hydraulic
Cement Types I, I (WRA), II, III, V

Trade Name and Synonyms:
Lehigh Portland Cement Types I, II, III, V
Lehigh Plastic Cement

2. EMERGENCY AND FIRST AID

EMERGENCY INFORMATION:	Portland cement is a light gray or white powder. When in contact with moisture in eyes or on skin, or when mixed with water, portland cement becomes highly caustic (pH > 12) and will damage or burn (as severely as third-degree) the eyes or skin. Inhalation may cause irritation to the moist mucous membranes of the nose, throat and upper respiratory system or may cause or may aggravate certain lung diseases or conditions. Use exposure controls or personal protection methods described in Section 10.
EYES:	Immediately flush eye thoroughly with water. Continue flushing eye for at least 15 minutes, including under lids, to remove all particles. Call physician immediately.
SKIN:	Wash skin with cool water and pH-neutral soap or a mild detergent. Seek medical treatment if irritation or inflammation develops or persists. Seek immediate medical treatment in the event of burns.
INHALATION:	Remove person to fresh air. If breathing is difficult, administer oxygen. If not breathing, give artificial respiration. Seek medical help if coughing and other symptoms do not subside. Inhalation of large amounts of portland cement require immediate medical attention.
INGESTION:	Do not induce vomiting. If conscious, have the victim drink plenty of water and call a physician immediately.
ACCIDENTIAL RELEASE MEASURES	Clean up spilled material without causing it to become airborne

or mixed with water to limit potential harm. Wear appropriate personal protective equipment. Dispose of waste material according to local, state or federal regulations.

3. COMPOSITION INFORMATION

DESCRIPTION:

This product consists of finely ground portland cement clinker mixed with a small amount of gypsum (calcium sulfate dihydrate). The portland cement clinker is made by heating to a high temperature a mixture of substances such as limestone, sand, clay and shale. Portland cement is essentially hydraulic calcium silicates contained in a crystalline mass, not separable into individual components. Major compounds are:

$3\text{CaO}\cdot\text{SiO}_2$	Tricalcium Silicate	CAS #12168-85-3
$2\text{CaO}\cdot\text{SiO}_2$	Dicalcium Silicate	CAS #10034-77-2
$3\text{CaO}\cdot\text{Al}_2\text{O}_3$	Tricalcium Aluminate	CAS #12042-78-3
$4\text{CaO}\cdot\text{Al}_2\text{O}_3\cdot\text{Fe}_2\text{O}_3$	Tetracalcium aluminoferrite	CAS #12068-35-8
$\text{CaSO}_4\cdot 2\text{H}_2\text{O}$	Calcium Sulfate dihydrate (Gypsum)	CAS #7778-18-9 (CAS #13397-24-5)

4. HAZARDOUS INGREDIENTS

COMPONENT	OSHA PEL (8-Hour TWA)	ACGIH TLV-TWA (1995-1996)	NIOSH REL (8-Hour TWA)
Portland Cement (CAS #65997-15-1) 50 to 95% by weight	5 mg respirable dust/m ³ 15 mg total dust/m ³	10 mg total dust/m ³	
Calcium sulfate (CAS #7778-18-9) [Gypsum (CAS #13397-24-5)] 0 to 10% by weight	5 mg respirable dust/m ³ 15 mg total dust/m ³	10 mg total dust/m ³	
Iron oxide (CAS #1309-37-1) 0 to 15% by weight	10 mg/m ³	5 mg/m ³	
Calcium carbonate (CAS #1317-65-3) 0 to 5% by weight	5 mg respirable dust/m ³ 15 mg total dust/m ³	10 mg total dust/m ³	
Magnesium oxide (CAS #1309-48-4) 0 to 5% by weight	15 mg total dust/m ³	10 mg total dust/m ³	
Calcium oxide (CAS #1305-78-8) 0 to 5% ¹ by weight	5 mg/m ³	2 mg/m ³	
Crystalline silica (CAS #14808-60-7) 0 to 5% by weight	<u>10 mg of respirable dust/m³</u> % SiO ₂ + 2 <u>30 mg of total dust/m³</u> % SiO ₂ + 2 <u>250 million particles/ft³</u> % SiO ₂ + 5	0.05 mg respirable quartz/m ³	0.05 mg respirable quartz dust/m ³

TRACE INGREDIENTS:

Due to the use of substances mined from the earth's crust, trace amounts of naturally occurring, potentially harmful constituents may be detected during chemical analysis. Portland cement may contain up to 0.75% insoluble residue. A small amount of this residue includes free crystalline silica. Portland cement also may contain trace (<0.05%) amounts of chromium salts or compounds (including hexavalent chromium) or other metals (including nickel compounds) found to be hazardous or toxic in some chemical forms. These metals are present mostly as trace substitutions within the principal minerals. Other trace constituents may include potassium and sodium sulfate compounds.

¹ If Portland/Lime blended product "0 to 25%" values.

5. HAZARD IDENTIFICATION

POTENTIAL HEALTH EFFECTS:

NOTE: Potential health effects may vary depending upon the duration and degree of exposure. To reduce or eliminate health hazards associated with this product, use exposure controls or personal protection methods as described in Section 10.

EYE CONTACT:

(Acute/Chronic) Exposure to airborne dust may cause immediate or delayed irritation or inflammation of the cornea. Eye contact by larger amounts of dry powder or splashes of wet portland cement may cause effects ranging from moderate eye irritation to chemical burns and blindness.

SKIN CONTACT:

(Acute) Exposure to dry portland cement may cause drying of the skin with consequent mild irritation or more significant effects attributable to aggravation of other conditions. Discomfort or pain cannot be relied upon to alert a person to a hazardous skin exposure.

(Chronic) Dry portland cement coming in contact with wet skin or exposure to wet portland cement may cause more severe skin effects, including thickening, cracking or fissuring of the skin. Prolonged exposure can cause severe skin damage in the form of chemical (caustic) burns.

(Acute/Chronic) Some individuals may exhibit an allergic response upon exposure to portland cement. The response may appear in a variety of forms ranging from a mild rash to severe skin ulcers.

INHALATION:

(Acute) Exposure to portland cement may cause irritation to the moist mucous membranes of the nose, throat and upper respiratory system. Pre-existing upper respiratory and lung diseases may be aggravated by inhalation of portland cement.

(Chronic) Inhalation exposure to free crystalline silica may cause delayed lung injury including silicosis, a disabling and potentially fatal lung disease, and/or cause or aggravate other lung diseases or conditions.

INGESTION:

(Acute/Chronic) Internal discomfort or ill effects are possible if large quantities are swallowed.

CARCINOGENIC POTENTIAL:

Portland cement is not recognized as a carcinogen by NTP, OSHA, or IARC. However, it may contain trace amounts of heavy metals recognized as carcinogens by these organizations. In addition, IARC classifies crystalline silica, a trace constituent, as a known human carcinogen (Group I). NTP has characterized respirable silica as "reasonably anticipated to be a carcinogen." (See also Section 13.)

6. PHYSICAL/CHEMICAL DATA

APPEARANCE/ODOR:	Gray, white or colored powder, odorless	PHYSICAL STATE:	Solid (Powder)
BOILING POINT:	> 1000°C	MELTING POINT:	Not applicable
VAPOR PRESSURE:	Not applicable	VAPOR DENSITY:	Not applicable
pH (IN WATER) (ASTM D 1293-95)	12 to 13	SOLUBILITY IN WATER:	Slightly soluble (0.1% to 1.0%)
SPECIFIC GRAVITY (H ₂ O = 1.0):	3.15	EVAPORATION RATE:	Not applicable

7. FIRE AND EXPLOSION

FLASH POINT:	None	LOWER EXPLOSIVE LIMIT:	None
AUTO IGNITION TEMPERATURE:	Not combustible	UPPER EXPLOSIVE LIMIT:	None
FLAMMABLE LIMITS	Not applicable	SPECIAL FIRE FIGHTING PROCEDURES:	None
EXTINGUISHING MEDIA:	Not combustible	UNUSUAL FIRE AND EXPLOSION HAZARDS:	None
HAZARDOUS COMBUSTION PRODUCTS:	None		

8. STABILITY AND REACTIVITY DATA

STABILITY:	Product is stable. Keep dry until used.
CONDITIONS TO AVOID:	Unintentional contact with water. Contact with water will result in hydration and produces (caustic) calcium hydroxide.
INCOMPATIBILITY:	Wet portland cement is alkaline. As such, it is incompatible with acids, ammonium salts and aluminum metal.
HAZARDOUS DECOMPOSITION:	Will not occur.
HAZARDOUS POLYMERIZATION:	Will not occur.

9. PRECAUTIONS FOR HANDLING, STORAGE AND DISPOSAL

HANDLING AND STORAGE	Keep dry until used. Handle and store in a manner so that airborne dust does not exceed applicable exposure limits. Use adequate ventilation and dust collection. Use exposure control and personal protection methods as described in Section 10.
SPILL:	Use dry clean-up methods that do not disperse dust into the air or entry into surface water. Material can be used if not contaminated. Place in an appropriate container for disposal or use. Avoid inhalation of dust and contact with skin and eyes. Use exposure control and personal protection methods as described in Section 10.

DISPOSAL:

Comply with all applicable local, state and federal regulations for disposal of unusable or contaminated materials. Dispose of packaging/containers according to local, state and federal regulations.

10. EXPOSURE CONTROLS/PERSONAL PROTECTION

RESPIRATORY PROTECTION:

Use local exhaust or general dilution ventilation to control dust levels below applicable exposure limits. Minimize dispersal of dust into the air.

If local or general ventilation is not adequate to control dust levels below applicable exposure limits or when dust causes irritation or discomfort, use MSHA/NIOSH approved respirators.

EYE PROTECTION:

Wear safety glasses with side shields or goggles to avoid contact with the eyes. In extremely dusty environments and unpredictable environments, wear tight-fitting unvented or indirectly vented goggles to avoid eye irritation or injury. Contact lenses should not be worn when handling cement or cement containing products.

SKIN PROTECTION:

Wear impervious abrasion- and alkali-resistant gloves, boots, long-sleeved shirt, long pants or other protective clothing to prevent skin contact. Promptly remove clothing dusty with dry portland cement or clothing dampened with moisture mixed with portland cement, and launder before re-use. If contact occurs, wash areas contacted by material with pH neutral soap and water.

11. TRANSPORTATION DATA

Portland cement is not hazardous under U.S. DOT regulations.

12. TOXICOLOGICAL AND ECOLOGICAL INFORMATION

For a description of available, more detailed toxicological and ecological information, contact Lehigh Cement Company.

13. OTHER REGULATORY INFORMATION

Status under US OSHA Hazard Communication Rule 29 CFR 1910.1200:

Portland cement is considered a hazardous chemical under this regulation and should be included in the employer's hazard communication program.

Status under CERCLA/Superfund, 40 CFR 117 and 302:

Not listed.

Hazard Category under SARA (Title III), Sections 311 and 312:

Portland cement qualifies as a hazardous substance with delayed health effects.

Status under SARA (Title III), Section 313:

Maybe subject to reporting requirements under Section 313. Contact sales office for further information.

Status under TSCA (as of May 1997):	Some substances in portland cement are on the TSCA inventory list.
Status under the Federal Hazardous Substances Act:	Portland cement is a hazardous substance subject to statutes promulgated under the subject act.
Status under California Proposition 65:	This product contains crystalline silica, a substance known to the State of California to cause cancer. This product also may contain trace amounts of heavy metals known to the State of California to cause cancer, birth defects or other reproductive harm.

14. OTHER INFORMATION

This MSDS provides information on various types of portland cement products. A particular product's composition may vary from sample to sample. The information provided herein is believed by Lehigh Cement Company to be accurate at the time of preparation or prepared from sources believed to be reliable. Health and safety precautions in this data sheet may not be adequate for all individuals or situations. Users have the responsibility to comply with all laws and procedures applicable to the safe handling and use of the product, to determine the suitability of the product for its intended use, and to understand possible hazards associated with mixing portland cement with other materials. This product neither contains nor is directly manufactured with any controlled ozone depleting substances, Class I and II. SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, CONCERNING THE PRODUCT OR THE MERCHANTABILITY OR FITNESS THEREOF FOR ANY PURPOSE OR CONCERNING THE ACCURACY OF ANY INFORMATION PROVIDED BY LEHIGH CEMENT COMPANY.

ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
ASTM	American Society for Testing and Materials
CAS	Chemical Abstract Service
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
ft ³	Cubic foot
IARC	International Agency for Research on Cancer
m ³	Cubic meter
mg	Milligram
MSHA	Mine Safety and Health Administration
NIOSH	National Institute for Occupational Safety and Health
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
REL	Recommended Exposure Limit
SARA	Superfund Amendments and Reauthorization Act
TLV	Threshold Limit Value
TSCA	Toxic Substance Control Act
TWA	Time Weighted Average

APPENDIX B
STANDARD OPERATING PROCEDURES



MEMORANDUM

TO: Emily Mosen

FROM: Michael Choratch

XC:

DATE: 01-22-2016

SUBJECT: SOP for preparing metal shredder residue samples for Terraphase Engineering.

1. The as-received samples will be logged in (assigned a HRI number).
2. Each sample will be weighed.
3. Each sample will be screened at 2mm and both the plus and minus 2mm fractions will be weighed.
4. The plus 2mm sample will be frozen in liquid nitrogen then knife-milled in a single pass.
5. The milled sample will be screened at 2mm.
6. The plus 2mm from the first pass will be frozen in liquid nitrogen then knife-milled.
7. The milled sample will be screened at 2mm and any remaining plus 2mm material will be frozen and knife milled in a third pass (if necessary).
8. All minus 2mm products will be recombined, weighed, blended and packaged.
9. All weights will be emailed to the client at the completion of each batch.
10. After each sample we clean the mill with acetone and a wire brush to ensure decontamination.