

Final Report

CONCRETE GRINDING RESIDUE CHARACTERIZATION

CALTRANS DISTRICT 11
TASK ORDER NO. 8

Prepared for



Prepared by:



Holmes & Narver

999 Town & Country Road
Orange California 92868

May 9, 1997

TABLE OF CONTENTS

1.0 Introduction..... 1

2.0 Project Background 1

3.0 Objective..... 1

4.0 Sample Collection..... 2

5.0 Sample Analyses..... 3

6.0 Analytical Results..... 3

 6.1 Fresh Water Samples 3

 6.2 Slurry Samples 4

7.0 pH Study 5

8.0 Toxicity Results 5

9.0 Conclusions..... 6

TABLES

Table 1 Analytes and Testing Methods (a, b, and c)..... 7, 8, 9

Table 2 Fresh Water Sample Analytical Results (a and b)..... 10, 11

Table 3 Slurry Sample Analytical Results - Filtrate and Solids (a and b)..... 12, 12(a)

Table 4 General Chemistry Analytical Results 13

Table 5 pH Concentration Changes 14

EXHIBITS

Exhibit 1 Project Location Map 15

FIGURES

Figure 1 Machinery used for roadway surface reconstruction work 16

Figure 2 Connection of Tanker Truck and Grinders..... 16

Figure 3 Holding Tank on Tanker Truck 17

Figure 4 Evaporation Ponds 17

Figure 5 Sampling Locations 18

APPENDICES

Appendix A Chain of Custodies

Appendix B Results of Chemical Analyses

Appendix C Results of Toxicity Analyses

CONCRETE GRINDING RESIDUE CHARACTERIZATION CALTRANS DISTRICT 11

1.0 Introduction

As requested by Caltrans Headquarters, Holmes and Narver has prepared this report on sampling and analysis of concrete grinding residue associated with the grinding operation of roadway surfaces for reconstruction. The project activity involved grinding the pavement surface of an approximately 32-mile long segment of Route 8 near El Centro, California in Caltrans District 11 from PM 41.0 to PM 73.0. Exhibit 1 shows the general project location.

2.0 Project Background

The grinding operation involved scraping the top surface of the concrete roadway and crushing it into powder. The machinery used for the grinding operation included Model PC-5000 and Model G-38 grinders, each equipped with 4 ft and 3 ft wide grinder heads, respectively (Figure 1). Each grinder worked in tandem with a tanker truck which supplied water for the operations. The tanker truck and the grinder were connected through a pair of hoses (Figure 2). Fresh water from the tanker truck was pumped to the work area of the grinding machine to cool its cutting heads. This water also formed a slurry with the concrete particles generated during grinding of the road surface. The slurry was continuously pumped back to the tanker truck using vacuum on the returning hose. The holding tank on the tanker truck had two separate compartments, one to store fresh water and the other to hold the slurry (Figure 3). The slurry compartment in the tanker truck was equipped with baffle plates and filters to facilitate the separation of solid material from water. As a means of reducing overall water usage, the water was recirculated several times to the grinder heads. Water recirculation proceeded until the solid material build-up in the aqueous phase interfered with the performance of the filters and the pumps, and at that point the slurry was discharged from the tanker trucks into evaporation ponds at an off-site location (Figure 4).

3.0 Objectives

The purpose of this project is to characterize the waste material generated by the roadway grinding operation for the presence of potentially hazardous and toxic components. Following are the specific objectives:

- ▼ Collect slurry samples from grinders; analyze the solid material and slurry filtrate from each sample for a select number of components.
- ▼ Collect samples of the fresh water which produced a slurry with the concrete particles and analyze each fresh water sample for a select number of components.
- ▼ Compare sample analytical results with the corresponding California Department of Toxic Substances Control (DTSC) Title 22 standards for hazardous wastes, and the California Drinking Water Standards.
- ▼ Conduct DTSC Acute Aquatic Toxicity testing on slurry filtrates and solids.

4.0 Sample Collection

The sample collection was conducted on February 20 and 21, 1997. The sampling activities were supervised by Dr. Zoltan C. Mester (Holmes & Narver) and the samples were collected by representatives of Ceimic Corporation (Daniel Tellez, Bharet Vandra), subcontractor for the field and analytical tasks of the project. Caltrans District 11 representatives, Shawn Rizzuto and Terry Cirilo were also present during the sampling operation.

One sample was collected from each of the operating grinders. On the days of sample collection the Contractor (Penhall Company) was operating six grinders on the eastbound lanes of Route 8 at the following locations:

GRINDER DESIGNATION	MODEL TYPE	POST-MILE	SAMPLE DESIGNATION
Grinder #1	G-38	41.7	S001
Grinder #2	PC-5000	55.1	S002
Grinder #3	G-38	44.6	S003
Grinder #4	G-38	56.4	S004
Grinder #5	PC-5000	57.7	S005
Grinder #6	PC-5000	57.8	S006

The sampling locations are depicted in Figure 5.

The grinders operated in two groups; two grinders (Grinders #1 and 3) worked near the beginning post-mile of the project site while the other four grinders (Grinders #2, 4, 5, and 6) operated approximately 12-15 miles away, due west along Route 8.

Slurry samples were collected by disconnecting the hose carrying the slurry from the grinder to the tanker truck. Since decoupling the slurry hose near the grinder machine would have caused extensive splashing, the hose was disconnected at the tanker truck to allow for safe sampling. At each grinder/tanker truck location separate slurry samples were collected for inorganic analysis (2.5 gallon plastic bottle), organics analysis (2 gallon glass jar), volatile organic compound analysis (VOC, 40 ml glass vial), and toxicity testing (2.5 gallon plastic bag). Samples were placed in an ice chest and kept cool for sample preservation purposes.

In addition to the slurry samples, fresh water used for grinding operation was also sampled to assess any potential impact of fresh water quality on the properties of the waste slurry material collected. The source of fresh water was the Alder Canal, located approximately 2 miles north from the intersection of Route 8 and Route 111, along Route 111.

The Colorado River is the primary water source for Alder Canal. Two fresh samples were collected from the water body of Alder Canal; one upstream (10 ft.) and one downstream (5 ft.) from the suction point of the pump used for supplying the tanker trucks with fresh water. At this location Alder Canal is bordered on the west by crop fields

Company. This yard is the site of the evaporation ponds used in the roadway work for ultimate disposal of the slurry content of the tanker trucks.

Two samples of recirculating water from Grinders #1 and 2 were also collected.

Sample collection and delivery to the analytical laboratory were conducted according to standard chain-of-custody protocol. The chain-of custody forms are included in Appendix A.

5.0 Sample Analyses

Samples for the chemical analyses were submitted to Ceimic Corporation, located in San Diego, California. Ceimic Corporation participates in the Performance Evaluation Audits (PEA) of EPA, Department of Defense (DoD), and California Department of Health Services and has been certified by these agencies for the analyses requested in this project.

Sample analyses were started immediately after the samples were delivered to the laboratory. A summary of analytical tests performed is presented in Table 2-I (a), (b) and (c). Fresh water samples were analyzed for the following: chlorinated pesticides/ herbicides, oil and grease, total petroleum hydrocarbons, Title 22 metals, anions, and properties referring to general chemistry (pH, Chemical Oxygen Demand, Total Dissolved Solids, and Total Suspended Solids).

Prior to analysis each slurry sample was separated into solid and aqueous phases (slurry filtrate) by gravity settling. Samples of the solid material and slurry filtrate were analyzed for a select number of components including the following: inorganics (Title 22 metals and other metals), semi-volatile organics, chlorinated organics, volatile organic compounds (VOCs), anions, oil and grease, total petroleum hydrocarbons, and properties referring to general chemistry (pH, Chemical Oxygen Demand, Total Dissolved Solids, and Total Suspended Solids). In addition, each separated solid material and slurry filtrate sample was submitted for DTSC Acute Aquatic Toxicity tests.

6.0 Analytical Results

The following describes the results of the chemical analysis for the fresh water and slurry samples. The results are reported in milligrams per liter (mg/l) for aqueous samples and milligrams per kilogram (mg/kg) for solid samples. All analyses were conducted according to accepted EPA or DTSC methods. The analytical results, including quality control data as provided by Ceimic Corporation, are included in Appendix B.

6.1 Fresh Water Samples

Fresh water sample, FW001 Downstream and FW002 Upstream, analytical results for the seventeen Title 22 regulated metals indicate that metal concentrations were below the sample detection limits except for arsenic, barium, cadmium, and selenium. The concentrations of these four metals were at levels well below the corresponding Title 22 limits and the applicable California Drinking Water Standards.

The presence of petroleum hydrocarbons was detected in FW001 at a low concentration of 1.0 mg/l. No petroleum hydrocarbons were detected in FW002. Oil and grease were not detected in either of the fresh water samples. Concentrations of chlorinated pesticides and herbicides were not detected above reportable detection limits.

Anions, chloride, nitrate/nitrite, and sulfate concentrations were above detection limits for both fresh water samples, but none of these values exceeded the corresponding California Drinking Water Standards. Both fresh water samples displayed slightly basic pHs of 8.15 and 8.07.

Chemical Oxygen Demand (COD) values, indicating the organic content of a sample amenable for chemical oxidation, were less than 5 mg/l for the both fresh water samples. Total Dissolved Solid (TDS) concentrations were 690 mg/l (FW001) and 698 mg/l (FW002). Total Suspended Solid (TSS) concentrations were 42 mg/l (FW001) and less than 20 mg/l (FW002), respectively.

Detailed analytical results for the fresh water samples are shown in Tables 2 and 4.

6.2 Slurry Samples

VOC analyses of slurry filtrate and solid samples indicated the majority of the VOCs analyzed for were not detectable except for benzene and toluene. In slurry filtrate samples S001 and S004 benzene was detected, but at levels below the Title 22 and California Drinking Water Standards. In slurry filtrate sample S006 the benzene concentration of 0.0011 mg/l was below the Title 22 standard (0.5 mg/l) but slightly exceeded the California Drinking Water Standard (0.001 mg/l).

Toluene was detected in slurry filtrate samples S001 (0.00078 mg/l), S002 (0.00057 mg/l), S003 (0.00063 mg/l), and S005 (0.00071 mg/l). These concentrations were all well below the California Drinking Water Standard (0.15 mg/l). Toluene has no Title 22 standard.

No ethyl benzene or xylenes were detected in any of the slurry filtrate or solid samples. No chlorinated pesticide or herbicide concentrations were detected above detection limits in any of the slurry filtrate or solid samples.

The analysis of semi-volatile compounds indicated the presence of benzoic acid in all slurry filtrate samples. The benzoic acid concentrations ranged from 0.065 mg/l to 0.760 mg/l. The only other semi-volatile compound detected was phenanthrene in solid sample S003 (0.43 mg/l). No Title 22 or California Drinking Water Standard exists for this compound.

All slurry samples (solid and slurry filtrate) showed concentration levels for oil and grease and total petroleum hydrocarbon (TPH) above detection levels. TPH levels were between 7.9-29.0 mg/l for the slurry filtrate and 16.0-62.0 mg/kg for the solid samples. For slurry filtrate and solid samples oil and grease concentrations ranged between 3.5-19.4 mg/l and 54.0-640.0 mg/kg, respectively. No corresponding Title 22 or California Drinking Water Standards exist for these constituents.

Title 22 metals analyses indicated concentrations of barium, copper, and chromium (as chromium III) present in all slurry filtrate and solid samples at levels below the corresponding Title 22 standards.

Detectable concentrations of other Title 22 metals (antimony, arsenic, cobalt, lead, molybdenum, nickel, selenium, vanadium, and zinc) were present in only a few slurry filtrate and solid samples. Cadmium was present in only one sample (slurry filtrate S002). All metals concentrations were below the corresponding Title 22 standards.

Concentrations for beryllium, mercury, silver, and thallium were below detection limits in all slurry filtrate and solid samples.

Metals concentrations in a limited number of samples exceeded the California Drinking Water standards. Chromium concentrations in the slurry filtrate samples S001 (0.11 mg/l), S002 (0.11 mg/l), S003 (0.05 mg/l), S004 (0.007 mg/l), and S006 (0.07 mg/l) met or exceeded the California Drinking Water Standard (0.05 mg/l). Antimony concentrations equaled or exceeded the California Drinking Water standard (0.006 mg/l) for slurry filtrate samples S001 (0.006 mg/l) and S002 (0.009 mg/l). The nickel concentration for slurry filtrate sample S002 (0.11 mg/l) slightly exceeded the California Drinking Water Standard (0.1 mg/l).

For the non-Title 22 metals (aluminum, magnesium, silica, iron, and calcium) analyzed in the slurry filtrate samples, concentrations of aluminum exceeded the California Drinking Water standard (1 mg/l) in samples S002 (30.2 mg/l), S005 (2 mg/l), and S006 (3.4 mg/l). Iron concentrations in slurry filtrate samples S002 (25.5 mg/l), S005 (1.72 mg/l), and S006 (3.15 mg/l) were higher than the California Drinking Water Standard (Secondary Maximum Contaminant Level: 0.3 mg/l).

With respect to anionic constituents in the slurry filtrate samples, the sulfate concentrations in all samples were higher than the California Drinking Water standard (Recommended Secondary Maximum Contaminant Level: 250 mg/l). Sulfate concentrations ranged between 376 mg/l (S003) and 611 mg/l (S004). Nitrite/nitrate concentrations exceeded the California Drinking Water Standard (10 mg/l) for slurry filtrate samples S001 (17.5 mg/l), S004 (12.5 mg/l), S005 (13.0 mg/l), and S006 (14.5 mg/l).

Total cyanide concentrations in all slurry filtrate samples were significantly lower (0.02-0.03 mg/l) than the California Drinking Water standard (0.2 mg/l).

COD values in the slurry filtrate samples ranged between 252 mg/l (S006) and 985 mg/l (S001). TDS concentrations varied between 1310 mg/l (S003) and 2490 mg/l (S001). TSS concentrations ranged from less than 20 mg/l (S003 and S004) to 122 mg/l (S005).

Detailed analytical results for the slurry samples (filtrates and solids) are shown in Tables 3 and 4.

7.0 pH Study

A separate experiment was conducted by the laboratory to assess pH changes of the slurry filtrate under evaporative conditions. The purpose of this experiment was to simulate field conditions of the off-site evaporation ponds and to determine the impact of evaporation on pH.

An aliquot of each slurry sample having 10% solid content was slowly evaporated in 24 hours at an average temperature of 36.4°C. The last reading was taken at 70°C to produce a highly concentrated solution. During the 24-hour-period a total of eight pH measurements were taken. For all samples the pH values declined as the evaporation proceeded. The original pH values ranged from 9.4-11.1, while the final values revealed less alkaline conditions (pH 8.23-9.63). No measured pH values exceeded Title 22 standards of <2 and >12. The study results suggest that under evaporating conditions the slurry filtrate becomes more neutral. The results of the pH study are shown in Table 5.

8.0 Toxicity Results

The toxicity study was conducted by MBC Applied Environmental Sciences, located in Costa Mesa, California. MBC Applied Environmental Sciences is a DTSC accredited laboratory to perform toxicity testing for this project. The toxicity study conformed to the requirements of Title 22, Article 6 of the

California Code of Regulations (CCR) 96-Hour Acute Toxicity testing. All slurry samples (solid and slurry filtrate) showed 100% survival results for the test fish (fathead minnows) used in the study.

The detailed results for the toxicity study, as provided by MBC Applied Environmental Sciences, are shown in Appendix C.

9.0 Conclusions

The following conclusions can be made from the results of the waste characterization study:

- ▼ The fresh water samples and the slurry samples (filtrate and solid) for inorganic and organic constituents displayed no hazardous characteristics when compared to the California Title 22 hazardous waste standards.
- ▼ California Drinking Water standards for antimony, aluminum, benzene, barium, chromium, iron, and nickel were variously exceeded in one or more slurry filtrate samples.
- ▼ Anionic concentrations for nitrite/nitrate and sulfate were higher than the corresponding California Drinking Water standards for the majority of the slurry filtrate samples.
- ▼ The 96-Hour Acute Toxicity testing showed no toxicity characteristics for the slurry samples (filtrate and solid) as manifested by the 100 % survival rate of the test fish. Based on these results, the slurry samples represent no toxic threat to public health and the environment.
- ▼ The pH characteristics of the disposed slurry do not exceed Title 22 standards.
- ▼ Analytical results from the different sampling locations did not reveal any significant compositional variability of the materials collected, therefore, it is reasonable to assume the results are representative for the entire project site.

TABLE 1a
ANALYTES AND TESTING METHODS
FOR
SLURRY FILTRATE

ANALYTE	EPA METHOD
• Organics	
Aromatic Volatiles	602/8020
Organochlorine Pesticides/PCB	608/8080
Oil & Grease	413.2
Total Petroleum Hydrocarbons	8015M
Semivolatile Organics	625/8270
Organic Lead	7421
• Inorganics	
Title 22 (CAM 17) Metals	6010/7000
STLC Extraction	Title 22
Aluminum	200.7/6010
Magnesium	200.7/6010
Iron	200.7/6010
Silica	200.7/6010
Calcium	200.7/6010
Chloride	9253
Nitrate/Nitrite	353.2
Sulfate	375.4/9038
Sulfide	376.2/9030
• General Chemistry	
pH	9040/9045
Chemical Oxygen Demand (COD)	410.2
Total Dissolved Solids (TDS)	160.1
Total Suspended Solids (TSS)	160.2
Fish Bioassay	Title 26 Hazardous Waste (96-hour)

TABLE 1b
 ANALYTES AND TESTING METHODS
 FOR
 SOLIDIFIED SLURRY

ANALYTE	EPA METHOD
• Organics	
Aromatic Volatiles	602/8020
Organochlorine Pesticides/PCB	608/8080
Oil & Grease	413.2
Total Petroleum Hydrocarbons	8015M
Semivolatile Organics	625/8270
Organic Lead	7421
• Inorganics	
Title 22 (CAM 17) Metals	6010/7000
STLC Extraction	Title 22
• General Chemistry	
pH	9040/9045
Fish Bioassay	Title 26 Hazardous Waste (96-hour)

TABLE 1c
 ANALYTES AND TESTING METHODS
 FOR
 WATER USED FOR GRINDING OPERATION

ANALYTE	EPA METHOD
• Organics	
Organochlorine Pesticides/PCB	608/8080
Total Petroleum Hydrocarbons	8015M
• Inorganics	
Title 22 (CAM 17) Metals	6010/7000
Chloride	9253
Nitrate/Nitrite	353.2
Sulfate	375.4/9038
Sulfide	376.2/9030
• General Chemistry	
pH	9040/9045
Chemical Oxygen Demand (COD)	410.2
Total Dissolved Solids (TDS)	160.1
Total Suspended Solids (TSS)	160.2

**Table 2a. Fresh Water Sample Analytical Results
Organic Analytes**

Sample ID	Halogenated Organics		Petroleum Compounds	
	Pesticides/PCBs	Chlorinated Herbicides	Oil & Grease	TPH ⁴
FW001 Downstream ¹	ND ²	ND	NA ³	1.0
FW002 Upstream	ND	NA	NA	ND

Title 22 Regulations STLC/TTLC ⁵	5/50 (mg/l, mg/kg) PCBs	10/100 ⁶ (mg/l, mg/kg)		
--	-------------------------------	--------------------------------------	--	--

NOTES:

1. Water sample results are reported in milligrams per liter (mg/l).
2. ND indicates a value below the reportable detection limit for the sample matrix.
Individual analyte detection limits are tabulated in Appendix B.
3. NA indicates that no analysis was performed for this analyte.
4. C7-C30, diesel fuel range.
5. Soluble Threshold Limit Concentration/Total Threshold Limit Concentration.
6. Based on 2,4-Dichlorophenoxyacetic acid (2,4-D)

Reference: California Code of Regulations (CCR), Title 22, Article 3.

**Table 2b. Fresh Water Sample Analytical Results
Inorganic Analytes**

Sample ID	Title 22 Metals										Non-Title 22 Metals					Anions												
	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Aluminum	Magnesium	Silica	Iron	Calcium	Chloride	Total Cyanide	Nitrate/Nitrite	Sulfate	Sulfide	
FW001 Downstream ¹	ND ²	ND	0.11	ND	0.0024	ND	ND	ND	ND	ND	ND	ND	0.006	ND	ND	ND	ND	NA ³	NA	NA	NA	NA	100	ND	0.20	244	ND	
FW002 Upstream	ND	0.004	0.11	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.004	ND	ND	ND	ND	NA	NA	NA	NA	110	ND	0.23	230	ND		
Title 22 Regulations (mg/l) STLC ⁴ California Drinking Water Standards (mg/l) ⁵	15	5	100	0.75	1	5	80	25	5	0.2	350	20	1	5	7	24	250											
	0.006	0.05	1	0.004	0.005	0.05		1	0.05	0.002		0.1	0.05	0.1	0.002		5	1					250	0.2	10	250		

NOTES:

1. Water sample results are reported in milligrams per liter (mg/l).
2. ND indicates a value below the reportable detection limit for the sample matrix. Individual analyte detection limits are tabulated in Appendix B.
3. NA indicates that no analysis was performed for this analyte.
4. Soluble Threshold Limit Concentration.
5. U.S. EPA Region IX Drinking Water Standards and Health Advisories Table, November 1996.

Source: California Code of Regulations (CCR), Title 22, Article 3.



Table 3a. Slurry Sample Analytical Results - Filtrate and Solids
Organic Analytes

Sample ID	Volatile Organics (VOCs)				Halogenated Organics			Petroleum Components		Semi-volatiles		
	Benzene	Toluene	Ethylbenzene	Xylene	Pesticides/PCBs	Chlorinated Herbicides	Oil & Grease	TPH ⁴	Benzoic Acid ⁵	Phenanthrene	Organic Lead	
S001 water ¹	0.00076	0.00078	ND ³	ND	ND	ND	19.1	29.0	0.760	ND		
S001 solid ²	ND	ND	ND	ND	ND	ND	140.0	16.0	ND	ND	ND	
S002 water	ND	0.00057	ND	ND	ND	ND	6.1	13.0	0.320	ND	ND	
S002 solid	ND	ND	ND	ND	ND	ND	640.0	46.0	ND	ND	ND	
S003 water	ND	0.00063	ND	ND	ND	ND	15.5	6.9	0.140	ND	ND	
S003 solid	ND	ND	ND	ND	ND	ND	120.0	41.0	ND	0.43	ND	
S004 water	0.00056	ND	ND	ND	ND	ND	19.4	14.0	0.270	ND	ND	
S004 solid	ND	ND	ND	ND	ND	ND	54.0	24.0	ND	ND	ND	
S005 water	ND	0.00071	ND	ND	ND	ND	6.6	9.1	0.065 ⁶	ND	ND	
S005 solid	ND	ND	ND	ND	ND	ND	160.0	62.0	ND	ND	ND	
S006 water	0.0011	ND	ND	ND	ND	ND	3.5	7.9	0.120	ND	ND	
S006 solid	ND	ND	ND	ND	ND	ND	110.0	29.0	ND	ND	ND	
Title 22 Regulations STLC ⁷	0.5 mg/l				5/50 (mg/l, mg/kg) PCBs	10/100 ⁸ (mg/l, mg/kg)					13 mg/kg	
California Drinking Water Standards (mg/l) ⁹	0.001	0.15	0.7									

NOTES:

1. Water sample results are reported in milligrams per liter (mg/l).
2. Solid sample results are reported in milligrams per kilogram (mg/kg).
3. ND indicates a value below the reportable detection limit for the sample matrix. Individual analyte detection limits are tabulated in Appendix B.
4. Water: C7-C30, diesel fuel range. Solids: C15-C30 diesel fuel range.
5. Results reported are for diluted samples.
6. Result reported for an undiluted sample.
7. Soluble Threshold Limit Concentration.
8. Based on 2,4-Dichlorophenoxyacetic acid (2,4-D)
9. U.S. EPA Region 1X Drinking Water Standards and Health Advisories Table, November 1996.

Source: California Code of Regulations (CCR), Title 22, Article 3



**Table 3b. Slurry Sample Analytical Results - Filtrate and Solids
Inorganic Analytes**

Sample ID	Title 22 Metals														Non-Title 22 Metals				Anions									
	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Aluminum	Magnesium	Silica	Iron	Calcium	Chloride	Total Cyanide	Nitrate/Nitrite	Sulfate	Sulfide	
S001 water ¹	0.006	0.006	0.1	ND ³	ND	0.11	ND	0.27	ND	ND	0.05	0.03	0.009	ND	ND	ND	ND	ND	0.92	38.1	ND	462	218	0.03	17.5	584	ND	
S001 solid ²	ND	8.4	190.0	ND	ND	6.8	2.4	15.0	6.3	ND	ND	7.9	ND	ND	ND	13.8	28.4						ND	ND				
S002 water	0.009	0.033	4.35	ND	0.0013	0.11	0.04	0.12	0.046	ND	0.04	0.11	0.004	ND	ND	0.11	0.19	30.2	32.6	65.1	654	134	0.02	7.2	448	ND		
S002 solid	ND	8.4	224.0	ND	ND	18.2	4.7	27.1	13.5	ND	ND	18.7	ND	ND	ND	21.8	46.9						ND ⁴					
S003 water	ND	ND	0.1	ND	ND	0.05	ND	0.06	ND	ND	0.02	ND	ND	ND	ND	0.03	ND	ND	6.59	22.7		207	135	ND	6.6	376	ND	
S003 solid	ND	9.7	166.0	ND	ND	10.0	1.7	22.4	9.9	ND	ND	7.7	ND	ND	ND	14.3	33.9						ND ⁴					
S004 water	ND	ND	0.08	ND	ND	0.07	ND	0.06	ND	ND	0.03	ND	ND	ND	ND	0.04	ND	ND	0.33	32.0		335	144	0.02	12.5	611	ND	
S004 solid	ND	8.7	347.0	ND	ND	18.5	3.2	53.8	11.8	ND	ND	32.5	ND	ND	ND	19.6	37.9						ND ⁴					
S005 water	0.004	ND	0.08	ND	ND	0.04	ND	0.002	0.002	ND	0.02	0.02	ND	ND	ND	0.04	ND	2	15	27.1	168	153	0.02	13.0	475	ND		
S005 solid	ND	2.3	51.0	ND	ND	8.0	1.4	9.2	3.3	ND	ND	5.3	ND	ND	ND	16.3	33.1						ND ⁴					
S006 water	ND	ND	0.10	ND	ND	0.07	ND	0.03	0.004	ND	0.04	0.02	ND	ND	ND	0.04	0.03	3.4	12.6	30.7	212	133	0.02	14.5	435	ND		
S006 solid	ND	2.7	66.0	ND	ND	9.7	2.6	12.6	5.5	ND	ND	6.8	ND	ND	ND	17.8	31.6						ND ⁴					
Title 22 Regulations (mg/l), STLC ⁵	15	5	100	0.75	1	5	80	25	5	0.2	350	20	1	5	7	24	250											
(mg/kg), TLTC ⁶ California Drinking Water Standards (mg/l) ⁸	500	500	10,000	75	100	2,500 ⁷	8,000	2,500	1,000	20	3,500	2,000	100	500	700	2,400	5,000											
	0.006	0.05	1	0.004	0.005	0.05		1	0.5	0.002		0.1	0.05	0.1	0.002		5	1	12.6	30.7	3.15	212	133	0.02	14.5	435	ND	

NOTES:

1. Water sample results are reported in milligrams per liter (mg/l).
2. Solid sample results are reported in milligrams per kilogram (mg/kg).
3. ND indicates a value below the reportable detection limit for the sample matrix. Individual analyte detection limits are tabulated in Appendix B.
4. Result outside of limits due to sample matrix interference.
5. Soluble Threshold Limit Concentration.
6. Total Threshold Limit Concentration.
7. Chromium and/or Chromium (III) Compounds.
8. Same as others.



**Table 4. General Chemistry Analytical Results
Fresh Water, Slurry Filtrate and Solid Samples**

Sample ID	pH (units)	COD ¹ (mg/L)	TDS ² (mg/L)	TSS ³ (mg/L)	Fish Bioassay - Percent Survivorship		
					250 mg/l	500 mg/l	750mg/l
FW001 downstream	8.15	<5.0	690	42	NA ⁴	NA	NA
FW002 upstream	8.07	<5.0	698	<20	NA	NA	NA
S001 water	10.45	985	2490	30	100%	100%	100%
S001 solid	9.70				100%	100%	100%
S002 water	10.60		1360	48	100%	100%	100%
S002 solid	10.20				100%	100%	100%
S003 water	9.63	384	1310	<20	100%	100%	100%
S003 solid					100%	100%	100%
S004 water	10.76	669	1880	<20	100%	100%	100%
S004 solid					100%	100%	100%
S005 water	9.66	381	1570	122	100%	100%	100%
S005 solid					100%	100%	100%
S006 water	9.69	252	1350	68	100%	100%	100%
S006 solid					100%	100%	100%

NOTES:

1. Chemical Oxygen Demand
2. Total Dissolved Solids
3. Total Suspended Solids
4. NA indicates no analysis performed.

Table 5
pH Concentration Changes
Under Evaporation Conditions

	Sample	TIME							
		t0	t1	t2	t3	t4	t5	t6	t7
		pH	pH	pH	pH	pH	pH	pH	pH
pH	pH blank	7.08	6.08	6.39	5.98	6.91	6.93	7.1	6.7
	S001	10.2	9.9	9.53	9.46	9.12	9.09	9.05	8.68
	S002	10.4	10.1	9.83	9.83	9.56	9.47	9.47	9.16
	S003	10.1	9.6	9.32	9.32	9.14	8.98	8.98	8.66
	S004	11.1	10.5	10.2	10.24	10.18	9.97	9.97	9.63
	S005	9.6	9.5	8.68	8.29	8.24	8.44	8.4	8.23
	S006	9.4	9.2	8.99	8.74	8.54	8.5	8.5	8.36

PROCEDURE: An aliquot of each sample was taken with 10% solid and put under evaporation conditions on a hot plate with an average temp of 36.4 C for 24 hours. Seven readings were taken for pH and volume of water evaporated. An extra reading was performed at the end of the 24 hours. Where the temperature was increased to 70 degrees C until the water was reduced to a level where the soil and water were at the same concentration (approximately 20 milliliters of water evaporated).



14 March 1997

CEIMIC Corporation
8808 Balboa Avenue
San Diego, California 92123

Attention: Mr. Daniel Tellez

Dear Mr. Tellez:

The following are the results of the California Department of Health Services (DOHS) 96-hour Acute Aquatic Toxicity tests performed on the samples 7273-03(S001), 7273-04(S001 solid), 7273-06(S002), and 7273-07(S002 solid) submitted on 25 February 1997. MBC utilized the latest California Department of Health Services procedures (Polisini 1988) for testing the sample.

The samples 7273-03(S001), 7273-04(S001 solid), 7273-06(S002), and 7273-07(S002 solid) **PASSED** the DOHS 96-hour Acute Aquatic Toxicity testing. Currently, Title 22, Section 66261.24, Article 6 of the California Code of Regulations requires wastes to pass the 96-hour Aquatic Toxicity testing with greater than 50% survival at the 500 mg/l concentration for compliance.

MBC Sample Number 97-173
Client Identification: 7273-03(S001)

PERCENT SURVIVORSHIP	
250 mg/l	100%
500 mg/l	100%
750 mg/l	100%

MBC Sample Number 97-174
Client Identification: 7273-04(S001 solid)

PERCENT SURVIVORSHIP	
250 mg/l	100%
500 mg/l	100%
750 mg/l	100%

CEIMIC Corporation
Mr. Daniel Tellez
14 March 1997
Page Two

MBC Sample Number 97-175
Client Identification: 7273-06(S002)

PERCENT SURVIVORSHIP	
250 mg/l	100%
500 mg/l	100%
750 mg/l	100%

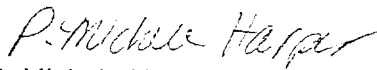
MBC Sample Number 97-176
Client Identification: 7273-07(S002 solid)

PERCENT SURVIVORSHIP	
250 mg/l	100%
500 mg/l	100%
750 mg/l	100%

If you have any questions or require further information, please contact me at your convenience.

Cordially,

MBC Applied Environmental Sciences



P. Michele Harper
Group Scientist

PMH/pb