4/23/15
Supplemental Packet
Item # 5

Golder Associates

TECHNICAL MEMORANDUM

Date:	March 31, 2015	**Project No.:**	123-81502.08
To:	Alan Sabawi	**Company:**	Lehigh Southwest Cement Co.
From:	Wes Oehmig, Victor Wirick		
cc:	Kevin Conroy, Tom Rutkowski		
RE:	**LEHIGH INTERIM TREATMENT SYSTEM OPERATIONS - SYSTEM PERFORMANCE REPORT (MARCH 31, 2015)**		

1.0 INTRODUCTION AND PURPOSE

The Lehigh Permanente Cement Plant and Quarry (Site), located at 24001 Stevens Creek Blvd., Cupertino, CA, is owned by Hanson Permanente Cement, Inc. and operated by Lehigh Southwest Cement Company. In accordance with Cease and Desist Order No. R2-2014-0011, issued by the San Francisco Regional Water Quality Control Board, (herein referred to as "CDO"), the Interim Treatment System (ITS) at the Site began treating quarry water prior to discharge via Pond 4A (Discharge Point No. 001 in the permit) in the fall of 2014. Beginning December 1, 2014, the ITS is required to remove total selenium (Se) by 50% from influent water, or achieve an effluent concentration of less than or equal to 10 µg/L Se if the influent is 20 µg/L Se or less.

1.1 Document Scope

Since ITS startup in October 2014, weekly monitoring has been conducted at the inlet and outlet of the ITS for the pollutants listed in the CDO, Table 1, for Discharge Point No. 001. This report is presented in compliance with the CDO, Table 3, Task f., which states: *"Provide a report evaluating and describing the effectiveness of the interim treatment system at reducing effluent concentrations of the pollutants listed in Table 1 for Discharge Point No. 001. In the evaluation of treatment effectiveness, compare pollutant concentrations in the interim treatment system effluent to those in the influent and to Permit effluent limitations."* The main objective of this report, therefore, is to use the weekly monitoring data to evaluate the performance of the ITS.

1.2 System Description

The ITS is a multiple-component water treatment system designed to treat at least 400 gallons per minute for the removal of total selenium. The system is composed primarily of two parallel bioreactor modules (manufactured and operated by Frontier Water Systems) and an effluent aeration tank. Selenium is reduced and retained in the anaerobic bioreactors through a biologically mediated process. The bioreactors also generate sulfide which precipitates some metals as metal sulfides within the bioreactors. The sulfide is generated through biological sulfate reduction.

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1.3 Sampling and Analysis

The pollutants listed in Table 1 of the CDO for Discharge Point No. 001 include selenium (Se), nickel (Ni), chromium (Cr(VI)), mercury (Hg), settleable matter, and turbidity. These parameters have been monitored with weekly sampling events and analyses. Sampling was carried out as 24-hr composite samples; the same composites were generally used for other parameters tested, except for Hg which was analyzed from grab samples.

A contracted laboratory, BC Laboratories, conducted all analyses for these parameters, except for Hg, which was subcontracted to another lab. The analytical methods used to quantify each parameter are:

- Se, Ni - EPA-200.8
- Cr(VI) - EPA-218.6
- Hg - EPA-1631E
- Settleable matter - EPA-160.5
- Turbidity - EPA-180.1

2.0 SYSTEM PERFORMANCE

The following sections detail the performance of the ITS for the treatment of selenium, chromium, nickel, mercury, settleable matter, and turbidity. Table 1 displays the concentrations of these parameters in weekly monitoring samples. Table 2 summarizes the system performance with monthly average concentrations for these parameters.

2.1 Total Selenium

Influent selenium concentrations (Table 1) ranged from 40 to 97 µg/L with an average of 61 µg/L since December 2014. In compliance with the CDO, Table 3, Task e., the ITS has removed selenium at a rate greater than 50% since December 1, 2014. Figure 1 shows influent, effluent, average monthly effluent concentrations, and removal percentage of total selenium. These are compared to the Maximum Daily Effluent Limit (MDEL) and Average Monthly Effluent Limit (AMEL) specified in the Permit (Regional Water Board Order R2-2014-0010).

Selenium removal has been consistently over 90% throughout the operational period, and has therefore met the task e requirement for 50% removal. Effluent concentrations have, with only one exception, met the permit MDEL of 8.2 µg/L. Average effluent concentration for all sample data has been 5.1 µg/L. Monthly averages (Table 2) have been at or near the permit AMEL of 4.1 µg/L since December 2014.

To date, selenium removal has far exceeded the removal goal of 50%, and has produced effluent concentrations consistently meeting the MDEL. Selenium treatment since January 1, 2015 has produced effluent with monthly average concentrations under the AMEL. The system has shown pronounced effectiveness in removing selenium, as supported by this performance data.

2.2 Total Nickel

As shown in Table 1, influent nickel concentrations have averaged 67 µg/L, and peaked at 110 µg/L. The removal of nickel has averaged 67% since December 1, 2014, and has been as high as 87%. Effluent concentrations (averaging 18 µg/L) have not exceeded the MDEL of 160 µg/L (Figure 2), and flow-weighted monthly averages have consistently been below the AMEL of 82 µg/L.

Though the ITS was chiefly designed for the removal of selenium, it has been effective in consistently reducing nickel concentrations as well. Nickel removal is likely occurring due to nickel sulfide precipitation within the bioreactors.

2.3 Hexavalent Chromium

Chromium (VI) has been present in the ITS influent in concentrations averaging 0.49 µg/L (with a maximum of 1.6 µg/L) since December 1 (Table 1). Effluent concentrations (Figure 3) have routinely been non-detect, signifying very high removal rates. On average, effluent chromium (VI) has been 0.014 µg/L, which is three orders of magnitude below the MDEL. Average monthly concentrations have similarly been far below the AMEL.

The removal of chromium (VI) by the ITS may be generally explained by biological reduction. The anaerobic conditions present in the ITS are suitable for the reduction of chromium (VI) to chromium (III) likely followed by precipitation of chromium (III).

2.4 Mercury

Mercury has been present in low concentrations in both the influent (average is 4.0 ng/L) and effluent (average is 1.5 ng/L) of the ITS. The ITS effluent has been below the MDEL and AMEL in all sampling events thus far (Figure 4). Based on these data, the system shows ability to remove mercury, even at very low influent concentrations. Mercury removal is likely occurring due to sulfide precipitation.

2.5 Settleable Matter and Turbidity

Settleable matter in the ITS influent and effluent has been largely non-detect (Table 1). With the exception of one sampling event, the effluent has consistently been below the MDEL of 0.2 mL/L-hr; monthly averages have all been below the AMEL.

The turbidity of influent water has been low, averaging 1.7 NTU (Table 1). Effluent trends show turbidity increasing with treatment (Figure 5) to a magnitude greater than the MDEL or AMEL in the CDO (average effluent concentration is 23 NTU), but well below the CDO interim limit. Organic solids from the bioreactors or precipitates associated with aeration may be possible explanations for this increase in turbidity. The ITS effluent turbidity is currently meeting the numeric interim effluent limitations provided in Table 2 of the permit. Upgrades to the ITS are being considered to meet the permitted discharge turbidity requirements by the stated task i date of March 31, 2016.

3.0 SUMMARY AND CLOSING

The Interim Treatment System has been in operation since October 1, 2014 and is currently meeting all interim and Table 3 task e limits, as identified in the CDO. Influent and effluent concentrations of selenium, nickel, chromium (VI), mercury, and settleable matter are consistently less than the final permit limits identified in the CDO. The bioreactor technology is effective not only for selenium removal, but also nickel, chromium, and mercury removal. Turbidity in the effluent is above final limits, and is seen to increase with treatment. Consideration is being given to improvements to the ITS system to meet the final permit limits for turbidity by the March 2016 task i deadline.

TABLES

Table 1: Weekly ITS Monitoring Data

	Se (ug/L)		Cr(VI) (ug/L)		Ni (ug/L)		Hg (ng/L)		Settleable Matter (mL/L-hr)		Turbidity (NTU)	
	INF	EFF	INF	EFF	INF	EFF	INF	EFF	INF	EFF	INF	EFF
MDEL	**-**	**8.2**	**-**	**16**	**-**	**160**	**-**	**41**	**-**	**0.2**	**-**	**10**
12/3/2014	93	7.0	0.22	ND	21	17	1.3	0.74	ND	ND	1.6	3.8
12/10/2014	97	12	0.28	ND	23	15	1.1	0.82	ND	ND	0.74	3.6
12/17/2014	44	2.0 J	1.6	ND	35	18	31 *	12 *	0.1	ND	3.7	4.7
12/22/2014	-	-	0.12 J	ND	110	37	0.83	0.49 J	ND	0.2	1.3	18
12/23/2014	56	2.1	-	-	-	-	-	-	-	-	-	-
12/29/2014	-	-	ND	ND	90	20	2.9	0.41 J	ND	0.1	3.2	33
12/30/2014	59	1.2 J	-	-	-	-	-	-	-	-	-	-
1/7/2015	58	1.5 J	0.44	ND	72	16	2.0	0.49 J	ND	ND	0.84	37
1/14/2015	56	1.8 J	0.41	ND	68	14	2.4	0.55	ND	ND	1.6	27
1/21/2015	71	2.8	0.55	ND	54	16	2.0	0.8	ND	ND	0.87	22
1/28/2015	59	3.9	0.14 J	ND	80	15	2.4	0.72	ND	ND	1.6	42
2/4/2015	62	3.7	0.31	0.071 J	58	12	1.6	0.87	ND	ND	1.0	18
2/11/2015	-	-	0.27	0.11 J	-	-	1.1	0.42 J	ND	ND	1.9	39
2/13/2015	44	1.4 J	-	-	99	13	-	-	-	-	-	-
2/19/2015	52	1.4 J	1.0	ND	76	21	1.6	0.47 J	ND	ND	1.7	27
2/25/2015	40	3.9	0.97	ND	90	26	1.5	0.68	ND	ND	2.6	30
Minimum	40	1.2	ND	ND	21	12	0.48	0.39	ND	ND	0.74	3.6
Maximum	97	12	1.6	0.12	110	37	31 *	12 *	0.1	0.2	3.7	42
Average	61	5.1	0.49	0.014	67	18	4.0	1.5	0.0077	0.023	1.7	23

Notes:

MDEL = Maximum Daily Effluent Limit

J = Detected, but not quantified

ND = Not detected

* = Data flagged for having significantly high relative percent difference compared to duplicates

Table 2: Monthly Average Concentrations

	Se (ug/L)		Cr(VI) (ug/L)		Ni (ug/L)		Hg (ng/L)		Settleable Matter (mL/L-hr)		Turbidity (NTU)	
	INF	**EFF**	**INF**	**EFF**	**INF**	**EFF**	**INF**	**EFF**	**INF**	**EFF**	**INF**	**EFF**
AMEL	**-**	**4.1**	**-**	**8.0**	**-**	**82**	**-**	**20**	**-**	**0.1**	**-**	**5.0**
December	70	4.9	0.49	0.00	63	22	7.4	2.9	0.020	0.060	2.1	13
January	61	2.5	0.38	0.00	69	15	2.2	0.64	0.00	0.00	1.2	32
February	50	2.6	0.64	0.046	81	18	1.5	0.61	0.00	0.00	1.8	29

Notes:

AMEL = Average Monthly Effluent Limit

FIGURES

Figure 1: Selenium (Se) Monitoring Data

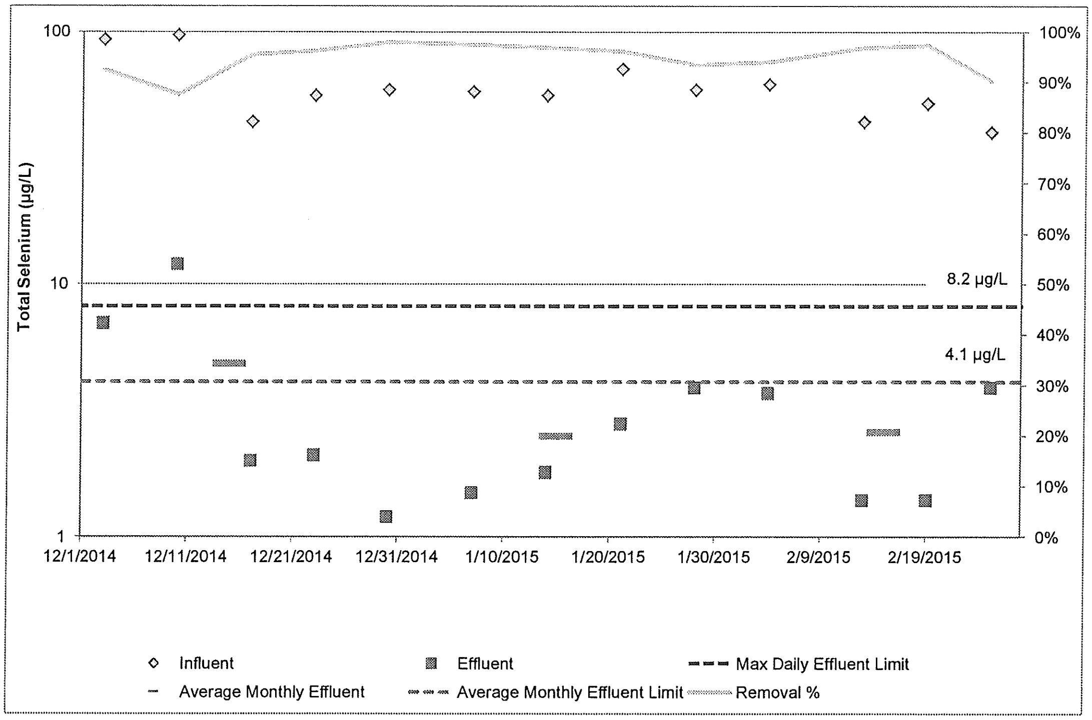

Figure 2: Nickel (Ni) Monitoring Data

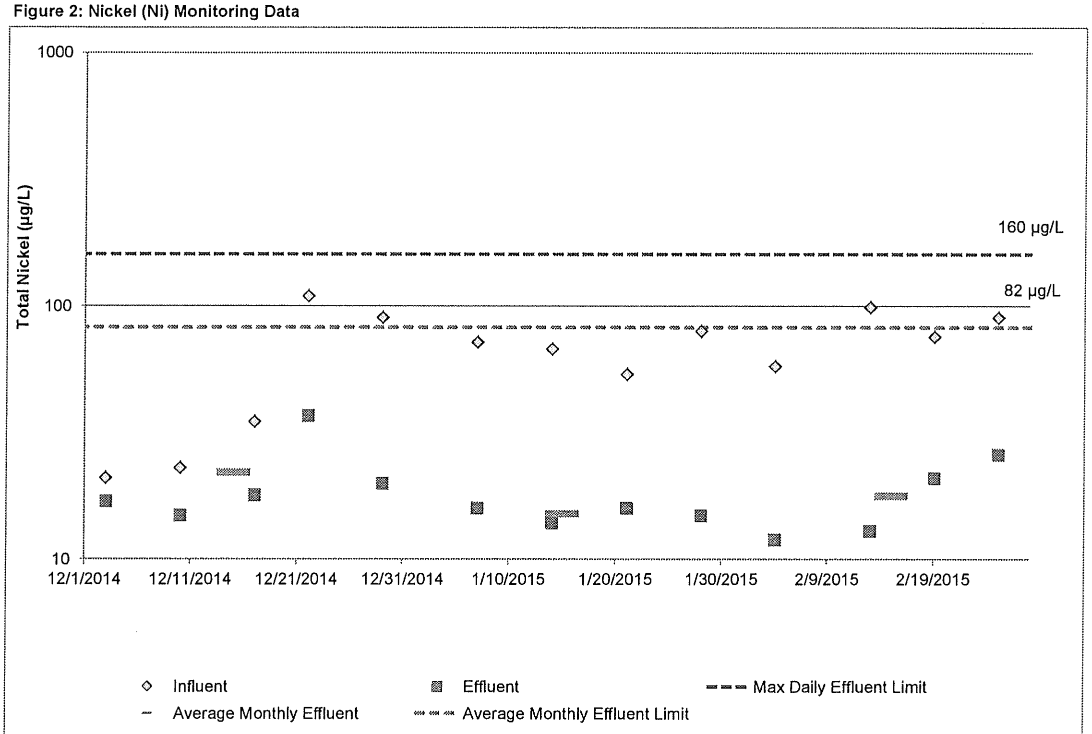

Figure 3: Hexavalent Chromium (Cr(VI)) Monitoring Data

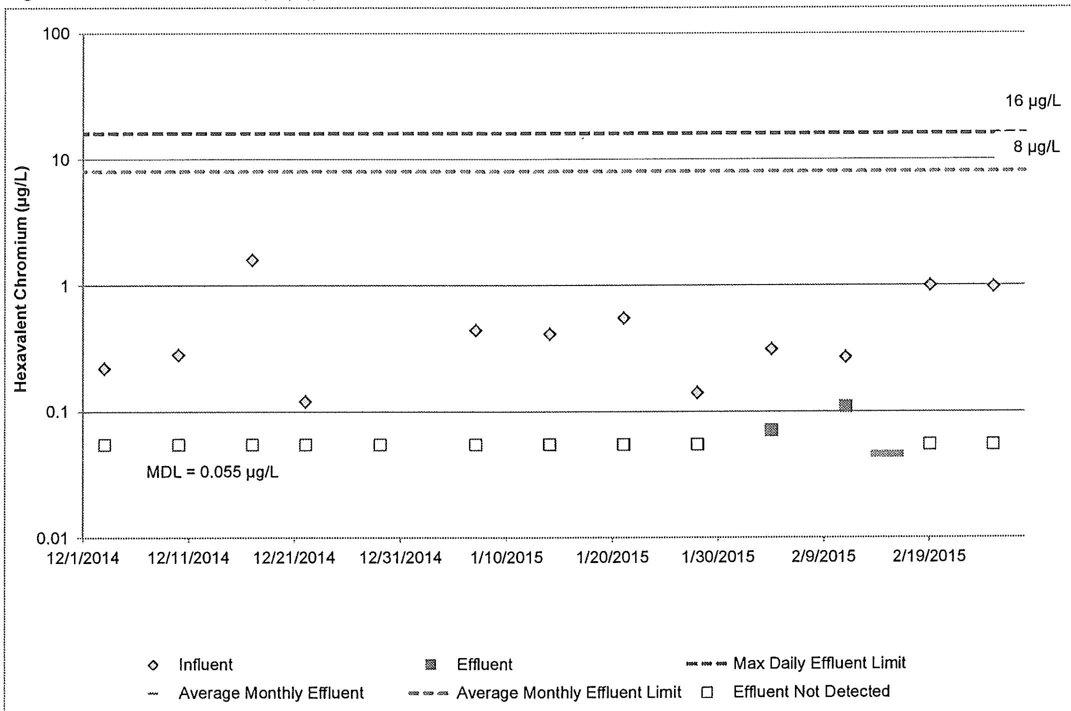

Figure 4: Mercury (Hg) Monitoring Data

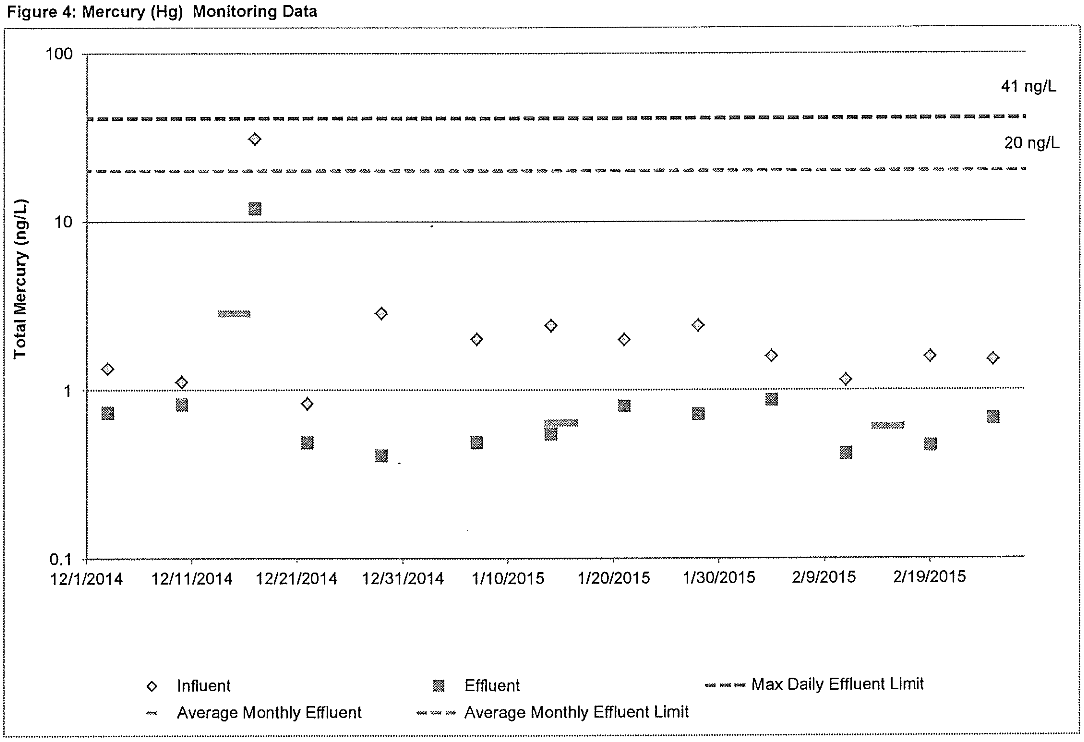

Figure 5: Turbidity Monitoring Data