MEMORANDUM

Date: August 16, 2011 **AMEC Project No.:** 1420112023

To: Richard Olm
Senior Environmental Engineer
Arizona Department of Environmental Quality
Waste Programs Permits Section

From: R. Jay Vanlandingham, RG, AMEC Sr. Project Manager
Julianne M. Hamilton, RG, AMEC Client Service Manager

Re: Revised Interim Summary Technical Memorandum
Cave Creek Landfill
Phoenix, Arizona

This memorandum is intended to summarize the points of discussion between the Arizona Department of Environmental Quality (ADEQ) and Maricopa County (County) to determine the additional activities that will meet the objectives of characterizing the site and to develop and implement a Remedial Action Plan. The following status report summarizes work performed to date as compared to the work plan entitled *Addendum to Cave Creek Landfill Groundwater Characterization Work Plan,* ADEQ Consent Order No. S-102-5, dated May 11, 2009 (Work Plan). This report includes the results of discussion between ADEQ and the County held on June 28, 2011. This report documents work performed pursuant to the Consent Order between the County and ADEQ, ADEQ Identification Number 30604, Docket No. S-2-10, dated January 19, 2010.

1.0 SUMMARY OF WORK PLAN TASKS

The Work Plan (AMEC 2009a) describes an approach to further characterize the lateral and downgradient extent of trichloroethene (TCE) in groundwater below the site, which includes the following activities:

- Vertical water quality profiling of groundwater in MW-2
- Adjustment of pump settings in groundwater monitoring wells PW, MW-2 and MW-3
- Lateral plume definition by test boreholes and installation of new monitoring wells
- Downgradient plume definition by test boreholes and installation of new monitoring wells

1.1 Vertical Profile of Groundwater in MW-2

A vertical profile of groundwater in MW-2 was collected on June 9, 2009. The samples were collected using passive diffusion bags. Concentrations observed in the passive diffusion bag samples decrease with depth, suggesting that the TCE in groundwater is near the surface and

AMEC Earth & Environmental, Inc.
1405 West Auto Drive
Tempe, Arizona 85284-1016
Tel (480) 940-2320
Fax (480) 785-0970 www.amec.com

not migrating downward at MW-2 at this time (AMEC 2009b). The results of those samples are summarized in Table 1.

Table 1 – Vertical Profile of TCE in MW-2, Cave Creek Landfill

Depth (feet)	TCE (µg/L)
695	190/150 (duplicate)
715	170
735	99

Note: µg/L = micrograms per liter

1.2 Adjustment of Pump Settings in PW, MW-2 and MW-3

As described in the Work Plan and with ADEQ's concurrence regarding final placement (ADEQ 2009) the pumps in PW, MW-2 and MW-3 were lowered on June 26, 2009. Pumps were lowered due to falling water levels over time. Adjusted pump settings are shown in Table 2.

Table 2 – Adjusted Pump Settings, Cave Creek Landfill

Well ID	Actual Top of Pump (feet btoc)	March 2009 Depth to Water (feet btoc)	Existing Pump Depth Below Water Table (feet)	Planned Pump Setting Activity	New Depth Below Water Table (feet)
PW	750	708.2	42	Remove 15-foot section (at surface)	21
MW-2	693	690.2	3	Add 1-foot-by- 21-foot section to avoid running pump dry in the upcoming months	24
MW-3*	777	699.9	77	Remove 3-foot-by- 21-foot sections and add 10-foot section (assumes well has all 21-foot lengths)	24

Note: btoc = below top of casing

1.3 Lateral Plume Definition

Lateral plume definition south of the new landfill, to the MCL concentration of 5 micrograms per liter (µg/L), was completed with the installation of monitor wells MW-4 and MW-5. Well locations and their associated concentrations are shown on Figure 1. Boring logs for MW-4 and MW-5 are included as attachments to this memorandum.

1.4 Downgradient Plume Definition

The downgradient plume definition south of the new landfill, to the MCL concentration of 5 µg/L, was completed with the installation of monitor well MW-6. The well location and its associated concentrations are shown on Figure 1. Boring logs for MW-6 are attached to this memorandum.

2.0 OTHER WORK PERFORMED

In addition to completing the work as described in the Work Plan, the County:

- Continues to sample landfill gas from perimeter wells
- Continues to conduct groundwater sampling
- Installed and sampled deep soil vapor monitor well TSSV-1

- Prepared a soil vapor extraction (SVE) work plan
- Completed a one-day SVE test

2.1 Soil Vapor Monitor Well TSSV-1

In January 2010 the County installed a multidepth deep-soil-vapor monitor well (TSSV-1) in the northeastern corner of the new transfer station at the Cave Creek Landfill (AMEC 2010). TSSV-1 has three screened intervals as shown on Table 3. Sampling for nonmethane volatile organic compounds (VOCs) was conducted on February 23, 2010, and results are summarized in Table 3.

Table 3 – Soil Vapor Concentrations in TSSV-1 Cave Creek Landfill

Screened Interval (feet bgs)	Soil Vapor Concentrations				
	Total VOCs (µg/L)	TCE (µg/L)	CH_4 (µg/L)	O_2 (%)	CO_2 (%)
150-200	280	130	0.013	16	2.4
350-400	315	200	0.0092	9.2	9.6
550-600	423	77	1	5.3	14

Notes: bgs = below ground surface, µg/L = micrograms per liter

2.2 Groundwater Sampling

Groundwater sampling is currently quarterly as approved by ADEQ in a letter dated May 19, 2010. However, the collection of water level measurements is continuing on a monthly basis. Groundwater elevations of PW, MW-2 MW-3, MW-4, MW-5 and MW-6 are used to calculate groundwater flow direction and magnitude. The concentrations of TCE in groundwater demonstrate that TCE is present above the maximum contaminant level (MCL) of 5 µg/L south of the new landfill. Water level elevations demonstrate a relatively flat flow direction that trends generally south to southeast. A summary of the historical groundwater quality monitoring since 2005, specifically focused on TCE concentrations, has been provided in Table 4 (AMEC 2011b). A summary of the previous 12-month water levels with gradient and flow direction are presented in Table 5 (AMEC 2011a).

Table 4 –Summary of Groundwater Quality Monitoring for the Cave Creek Landfill

	Groundwater Sampling Results –TCE (µg/L)						
Date	PW	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6
10/20/2005	11	15	ND	NA	NA	NA	NA
10/27/2005	7.8	13	ND	NA	NA	NA	NA
11/10/2005	4.8	16	ND	NA	NA	NA	NA
12/8/2005	15	15	ND	NA	NA	NA	NA
1/12/2006	16	17	ND	NA	NA	NA	NA
2/10/2006	44	17	ND	NA	NA	NA	NA
3/10/2006	20	21	ND	NA	NA	NA	NA
4/13/2006	15	20	ND	NA	NA	NA	NA
5/9/2006	10	24	ND	NA	NA	NA	NA
6/20/2006	11	29	ND	NA	NA	NA	NA
7/13/2006	15	29	ND	NA	NA	NA	NA
8/16/2006	12	29	ND	NA	NA	NA	NA
9/19/2006	3	11	ND	NA	NA	NA	NA
10/13/2006	1.5	9.4	ND	NA	NA	NA	NA
11/13/2006	12	40	ND	NA	NA	NA	NA
12/13/2006	22	3	ND	NA	NA	NA	NA
1/18/2007	13	59	ND	NA	NA	NA	NA
2/21/2007	12	63	5.9	NA	NA	NA	NA
3/20/2007	10	66	7.2	NA	NA	NA	NA
4/16/2007	11	59	8.7	NA	NA	NA	NA
5/22/2007	11	57	12	NA	NA	NA	NA
6/12/2007	9.4	57	15	NA	NA	NA	NA
7/18/2007	8.8	55	18	NA	NA	NA	NA
9/18/2007	1.9	NA	32	NA	NA	NA	NA
10/24/2007	8.6	NA	39	NA	NA	NA	NA
11/16/2007	18	NA	16	NA	NA	NA	NA
12/19/2007	2.5	NA	65	NA	NA	NA	NA
1/12/2008	3.5	NA	66	NA	NA	NA	NA
2/20/2008	18	NA	48	ND	NA	NA	NA
3/12/2008	1.5	NA	130	ND	NA	NA	NA
4/16/2008	1.3	NA	120	ND	NA	NA	NA
5/20/2008	10	NA	120	ND	NA	NA	NA
6/16/2008	1.3	NA	150	ND	NA	NA	NA
7/18/2008	43	NA	190	ND	NA	NA	NA
8/13/2008	53	NA	190	ND	NA	NA	NA
9/15/2008	69	NA	140	ND	NA	NA	NA

Date	Groundwater Sampling Results –TCE (µg/L)						
	PW	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6
10/16/2008	83	NA	190	ND	NA	NA	NA
11/14/2008	70	NA	150	ND	NA	NA	NA
12/12/2008	76	NA	240	ND	NA	NA	NA
1/13/2009	110	NA	320	ND	NA	NA	NA
2/12/2009	85	NA	270	ND	NA	NA	NA
3/12/2009	85	NA	280	ND	NA	NA	NA
4/10/2009	110	NA	330	ND	NA	NA	NA
5/12/2009	76	NA	290	ND	NA	NA	NA
7/15/2009	2.9	NA	380	ND	NA	NA	NA
8/14/2009	6.3	NA	390	ND	NA	NA	NA
9/17/2009	3.8	NA	400	0.85	NA	NA	NA
10/15/2009	3.1	NA	430	ND	NA	NA	NA
11/12/2009	3.9	NA	340	ND	NA	NA	NA
12/11/2009	8	NA	410	0.79	NA	NA	NA
1/13/2010	9.3	NA	400	ND	NA	NA	NA
2/17/2010	9.5	NA	410	ND	NA	NA	NA
3/10/2010	12	NA	340	0.52	NA	NA	NA
4/16/2010	42	NA	450	ND	NA	NA	NA
6/16/2010	5.2	NA	420	1.4	NA	NA	NA
9/13/2010	38.3	NA	428	0.66	NA	NA	NA
11/16/2010[a]	21.2	NA	412	0.74	5.21	NA	NA
11/24/2010[a]	24.2	NA	264	1.59	5.31	NA	NA
3/8/2011	30.5	NA	215[b]	0.88	5.87	ND	NA
3/30/2011[b]	NS	NA	303[b]	NS	NS	NS	NA
5/26/2011	39.6	NA	315	1.01	4.65	ND	0.910

Notes:

a. Fourth quarter 2010 groundwater sampling was conducted on November 16, and groundwater was resampled on November 24, 2010, at site monitor wells due to potential cross contamination in monitor well MW-4 from MW-2.

b. Monitor well MW-2 was resampled on March 30, 2011, to confirm the reported TCE result for March 8, 2011.

NA = not available: Well was either not installed, out of service or not scheduled for sampling.

ND = nondetect: The TCE concentration was not detected above the laboratory detection limit of 0.50 µg/L.

NS = not sampled

µg/L = micrograms per liter

Table 5 – 12-Month Summary of Elevation Data for the Cave Creek Landfill

Date	Groundwater Elevation (ft amsl)						Flow Direction (azimuth)	Gradient (feet/foot)
	PW	MW-2	MW-3	MW-4	MW-5	MW-6		
5/20/2010	1171.64	1163.63	1164.18	NA	NA	NA	165.2	0.0029
6/16/2010	1171.64	1163.88	1164.13	NA	NA	NA	158.6	0.0029
7/20/2010	1171.74	1163.28	1163.98	NA	NA	NA	167.9	0.0030
8/13/2010	1171.74	1163.33	1164.08	NA	NA	NA	169.1	0.0030
9/13/2010	1171.64	1163.53	1163.83	NA	NA	NA	159.4	0.0030
10/15/2010	1171.88	1163.28	1163.99	NA	NA	NA	167.8	0.0030
11/16/2010[1]	1171.83	1163.19	1164.11	NA	NA	NA	170.6	0.0030
12/16/2010	1171.79	1163.28	1164.58	1162.55	NA	NA	180.4	0.0029
1/11/2011	1171.77	1163.08	1163.98	1162.39	1162.02	NA	174.4	0.0030
2/15/2011	1171.80	1163.17	1165.03	1162.95	1162.60	NA	180	0.0028
3/8/2011	1171.74	1163.23	1164.13	1162.55	1162.03	NA	178	0.0029
4/30/2011	1171.79	1163.33	1164.28	1162.70	1162.20	NA	176.2	0.0029
5/26/2011	1171.70	1163.38	1164.18	1162.65	1162.15	1164.81	270	0.0018

Notes:
All reported groundwater elevations reflect the survey conducted by the Maricopa County Registered Land Surveyoron June 7, 2011.
NA = not applicable; well was not installed
NM = not measured
ft amsl = feet above mean sea level

2.3 Soil Vapor Extraction Work Plan

The County has submitted a SVE work plan that calls for conducting a one-day SVE test followed by an extended SVE pilot test. The objective of the SVE work plan is to evaluate whether sustained concentrations of compounds of concern exist in soil vapor in the vicinity of the TSSV-1 and PW wells. Secondary objectives of the test are to 1) estimate relative distance from TSSV-1 and PW to the source area(s), 2) estimate pneumatic conductivity of the soils at various depths, 3) estimate the radius of influence and travel times, 4) evaluate persistence of the soil vapor concentrations at various depths, and 5) estimate a mass removal rate for the compounds of concern. The one-day SVE test is intended to collect information for designing the extended SVE test. As of the date of this memorandum, the one-day SVE test has been completed, but the extended SVE pilot test has not yet been completed. Discussion of the extended SVE test has been deferred to Section 3.4 because it is not yet complete and is considered part of planned work.

2.4 One-Day Preliminary SVE Pilot Test

The one-day preliminary SVE pilot test was completed in June 2010. The results of the test confirmed that the general design for the extended SVE pilot test will include three 2,000-pound

vapor-granular activated carbon (VGAC) vessels and a 500 standard-cubic-feet-per-minute (scfm) blower.

3.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the data collected to date and discussion with ADEQ:

- The TCE in the groundwater south of the new landfill is defined to the 5 µg/L MCL; therefore, no additional monitor wells are necessary south of the new landfill at this time. The plume does not appear to extend under homes to the south and east of the landfill at this time.
- The TCE in the groundwater south of the old landfill is not defined to the 5 µg/L MCL, therefore the County proposes characterizing groundwater downgradient of the old landfill. The County will submit a letter work plan to install a well down gradient of the old landfill.
- The long-term groundwater quality and gradient trends remain under evaluation and ongoing groundwater sampling is necessary and will be continued on a quarterly schedule.
- Implementation of the extended SVE pilot test should be undertaken at the earliest possible opportunity. The County will submit a response to comments on the Final SVE Work Plan.
- VOC analyses of landfill gas have been requested by ADEQ; therefore, the County will collect additional information relative to VOCs from landfill gas during the extended SVE pilot test.
- Quarterly Landfill gas monitoring is ongoing.
- Monthly groundwater level monitoring is ongoing.

4.0 REFERENCES

Arizona Department of Environmental Quality (ADEQ). 2009. Email correspondence from Michael N. Prigge to Misael Cabrera, Subject: Pump Depth Setting at CCL, at 4:59 p.m. June 25.

AMEC Earth & Environmental (AMEC). 2009a. *Addendum to Cave Creek Landfill Groundwater Characterization Work Plan.* Prepared for Maricopa County Solid Waste Management Department. May 11.

AMEC 2009b. Email correspondence from Misael Cabrera to Michael N. Prigge, Subject: Pump Depth Setting at CCL, 4:59 p.m. June 24.

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AMEC. 2011a. *Draft Cave Creek Landfill Status Report, May 2011.* Prepared for Maricopa County Solid Waste Management Department. June 10.

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